A MANUAL

OF

ARCHITECTURE:

FOR

CHURCHES, PARSONAGES, AND SCHOOL-HOUSES.

CONTAINING

Designs, Elevations, Plans, Specifications,

FORM OF CONTRACT, RULES FOR ESTIMATING COST OF BUILDING,

WITH SUGGESTIONS ON

Acoustics, Ventilation, Heating, Lighting, Painting, etc.

BY THE REV. W. M. PATTERSON.

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WITH AN INTRODUCTION BY R. A. YOUNG, D.D.

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PUBLISHING HOUSE OF THE METHODIST EPISCOPAL CHURCH, SOUTH.
1875.

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K.B.O. 30, 1911

To all True and Faithful

Workers in the Master's Cause

This Volume is Affectionately Inscribed,

By one who would

Lighten their Labors and Increase their Success.

INTRODUCTION.

I HAVE spent two evenings very pleasantly and profitably over the pages and pictures of the Rev. W. M. PATTERSON'S "Manual of Architecture for Churches, Parsonages, and School-houses." I do not know when I have obtained more valuable practical instruction from a book. It is certainly the best treatise I have read on the subject. Here the Southern Methodist can learn all he needs to know about church-building, from the selection of a suitable lot up to the dedication of a completed and furnished house of worship.

For example: I received a letter this morning from Dr. AUSTIN W. SMITH, pastor of our Church in Columbia, Tenn. He inquires, "How shall we light our new church?" I reply to him, "Get W. M. PATTERSON'S new work on Church Architecture, turn to page 71, and you will find a chapter on lighting the church. Lamps, chandeliers, and reflectors are considered. I give the preference to reflectors. Three or four will be as many as you will need. The Manual tells you where to purchase, and how to put them up."

The author of this book is famous for building churches. If the congregation does not want a new house, he remodels the old one. If Israel is satisfied to worship in an unfinished place, he reproves and exhorts like Haggai. Indeed, Bishop MARVIN long since named him "Haggai, the temple-builder;" and I predict that when he has dedicated and paid for a new house of worship where he is now stationed, he will get up and go somewhere else—not because he is not a capital preacher and a first-rate pastor, but to employ his genius for sacred architecture.

I have occupied the pulpits of three churches whose plans and specifications are given in this work, and I am free to say that I have never known them surpassed for easy speaking or easy hearing. Let building committees send immediately for this Manual. Let no young preacher, who means to be something and do something in his sacred calling, remain without it.

R. A. YOUNG.

NASHVILLE, April 13, 1875.

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PREFACE.

THIS volume is presented to the public in answer to an evident necessity and urgent demand for practical information on the subject of building. A new and interesting era in Church enterprise has dawned upon us. Our people are at present manifesting more of the spirit of improvement, in both the number and character of our church, school, and pastoral edifices, than has hitherto been known in the history of the South. Willing minds, ready hands, and the gifts of liberal hearts, are rapidly replacing the buildings which have been destroyed; remodeling, repairing, and improving those which have become dilapidated and out of date, and erecting new ones in localities heretofore unoccupied.

To encourage this spirit where already existing, to awaken and develop it where these important interests still receive but little or no attention, and to make the building enterprises undertaken result in the greatest possible good to the cause they are intended to advance, special action has been taken by some branches of the Protestant Church with reference to this department of their work. The General Conference of the Methodist Episcopal Church, South, at its last two sessions, passed resolutions calling for the publication of a work on Church Architecture. Other denominations have gone farther, and separated the work of Church extension from all other, and provided measures and means to make their efforts in enterprises of this sort more successful and satisfactory. This course, where adopted, has given a more pleasing and promising phase to the building interests of the Church.

It is desirable not only to increase the number of our churches, parsonages, and school-houses, but also to improve their general architectural style, to bring about the observance of better rules in their arrangement and construction, and to make their conveniences as many and as great as possible for the amount of money and labor expended; thus securing the most beneficial results. The aim should be to combine duly in every structure adaptation, beauty, and economy. In the larger number of instances our church-building is an experiment; not an effort to improve on the past, but a move in the dark—being directed by those who have previously given the subject no attention whatever. Hence the numerous witnesses to the effect that, in their cases, the above-men-

tioned combination has in no part been accomplished. When the edifice has been brought to completion, through much trouble, delay, and expense, it is easy enough to see where better arrangements could have been made, where other conveniences could have been added, where money could have been saved, how the comfort of the congregation and the minister could have been increased, and the result made much more satisfactory to all concerned. But no benefit can come from such experience and such failures, for those persons are likely to build but the one house in a life-time.

These mistakes and grievous disappointments may be almost invariably prevented, and the general cause advanced, by the use of such a Manual as the author has endeavored to make this one.

It is true that a great number and variety of architectural books have already been published, in both Europe and America—some of them eminently meritorious, being the production of the best talent, the greatest scientific research and practical skill of the profession; but the circulation of these works is necessarily very limited, on account of their great expense—that is, such of them as contain the amount and character of information needed. The author has found no work on architecture accomplishing the objects contemplated in the publication of this book. *None have furnished the same amount of practical matter in the same space, and at the same cost.*

Other circumstances might have justified the author in carrying out his desire and original purpose to treat more elaborately and scientifically many of the subjects coming within the legitimate purview of a work of this sort; but such a course would have defeated one of his most cherished objects. The increased length of the articles, and the consequent increased cost of the book, would have prevented its being so generally read and extensively used by those who need it most, and for whose benefit it is specially intended.

In the letter-press only the plainest terms are used, and in the designs given all elaborate and extravagant ornamentation has been avoided. No "*gorgeous*" churches are here presented. The lowest cost contemplated is $1,000. The one costing the most—Church Design No. 10—was erected in Memphis, Tenn., for less than $25,000—although excellent judges have pronounced it equal to some others costing four times that sum.

The author has sought to make this work eminently practical, so as to enable those about to build to select such a design as will suit their taste, meet their wants, and come within the limit of their resources. Then, with book in hand, they can commence and carry forward to completion whatever design may be adopted, without paying the extra cost of an architect's services. And the arrangement is such as to allow any changes that may be desired—provided there be no violation of the rules of architectural propriety in the combination of *different styles of architecture.* For instance: Church Design No. 9

may be constructed with the spire of No. 7; the windows of Parsonage Design No. 3 may be used in No. 5, etc. Any of the designs may be modified, or elaborated, as circumstances may demand or taste suggest.

Another item considered worthy of attention is to make known the facilities for obtaining certain articles used in the construction or furnishing of our houses. If a church is to be covered with iron, lighted with something better than a candle or common coal-oil lamp, heated with hot air, water, or steam, or furnished with comfortable and elegant pews, the committee having the matter in charge are here informed where, and of whom, the articles desired may be procured. Great care has been taken to recommend only the most reliable parties.

The style, type, and binding of the book are well adapted to the use of the workmen, who are supposed to be sufficiently skilled in their trade to execute readily the directions given.

This book is not without its imperfections; but it is the hope of the author that a generous public, in sympathy with its objects, and disposed to encourage every effort in that direction, will pass over these imperfections, and accept and use whatever of good it may contain or suggest. He trusts that the many friends who have recommended his undertaking this work will not be disappointed in their expectations. He prays that his labors may result in much good to the Church of God.

Acknowledgments are due to the Rev. Bishop E. M. Marvin, D.D., for his excellent article on "Church Extension," and to the Rev. Bishop W. M. Wightman, D.D., for his admirable article on the subject of "Parsonages." Credit is likewise due to A. J. Bicknell & Co., Architectural Publishers, New York, for valuable suggestions from their most excellent work, "The Village Builder," and especially for the use, by permission, of the front elevation of Parsonage Design No. 7, which has been but slightly changed to adapt it to the ground-plan. The publications of Geo. E. Woodward, New York, have also been of great service to the author.

W. M. PATTERSON.

CHURCHES.

A MANUAL OF ARCHITECTURE

FOR CHURCHES, PARSONAGES, AND SCHOOL-HOUSES.

CHURCH EXTENSION.

By the Rev. Bishop E. M. Marvin, D.D.

IT is the bounden duty of the Church to bring the ministry of the word in reach of every individual, and especially of every family. In the newer regions of the country, where population is rapidly increasing, this will require an incalculable degree of energy and the outlay of large sums of money. Even in those States which have been longest settled much remains to be done. There is unoccupied space between pastoral charges, and in many instances whole communities are too remote from any church to enjoy, in any thorough measure, the stated means of grace. In the country, so far as the Methodist Church is concerned, it is often the case that adjoining circuits are not properly coterminous; and even in the area of a given circuit there are, in many instances, large communities to which no church is accessible. This is the case more particularly in mountainous and other thinly-populated regions. In such places the people are generally of the poorer class: it is therefore difficult to build churches, or to support the gospel after houses have been provided. Taking the country over, there is a sufficient number of people destitute of the means of grace to give the Church cause of deepest solicitude. In the large cities the deficiency is even greater. There are peculiar conditions of life in the great cities which complicate the question in the most perplexing and painful manner. It is often more difficult to fill houses than to build them; countless multitudes are utterly indisposed to appear in the house of God.

In fact, the work of Church extension at home is by no means less important than that of Missionary enterprise abroad. I do not mean to intimate that the latter is to be postponed to the former—far from it; on the contrary, the highest efficiency in either is to be realized only in the earnest prosecution of both. The Church that is indifferent to the conversion of the world will be found to have fallen into a state of inanition in which it will accomplish little or nothing at home.

To a great extent the work of Church extension in any given locality must be done by the Churches and preachers in the vicinity. *On them* is the immediate responsibility;

they are face to face with the need; the cry is in their ears. Every pastor ought to feel bound to invade unoccupied neighborhoods within his reach, and his Church ought to second his efforts in the most hearty spirit. It was in this manner that the early Methodist preachers wrought such wonders in spreading the gospel. They could not rest unless they were perpetually going into destitute regions. The hum-drum pastor who is satisfied with routine duties in a line of things made ready to his hands, and with whom the most important consideration is his salary, is in humiliating contrast with those devoted men.

No definite rule can be given as to the proper distance of one church from another, in the country. There have been some instances, no doubt, of houses of worship being built too near each other. By this means one powerful society, efficiently served by the ministry of the word, has been divided into two feeble ones, inadequately served. Thus, injudicious and inopportune division is followed by decay. This arises sometimes from neighborhood feuds; sometimes, again, in locating a church the defeated contestants refuse to be reconciled, and *will* have another house. In other cases, it comes of a well-meant, but mistaken, effort to bring the gospel to every man's door. This matter must, of necessity, be decided by the communities immediately interested; but the voice of the preacher, who is free from local prejudices, ought to be heard with deference. The topography and populousness of the country, and the condition of the people, must be taken into the account.

After there is a church for every community, and they are as near to each other as the general good demands and circumstances warrant, it will be found that there are many individuals, at the more remote points, unable to attend habitually upon the means of grace. Some, perhaps, will not have the means of conveyance, and the distance may be too great to walk, especially for the aged and feeble. Children may be unable to attend Sunday-school. An active, conscientious pastor will be able to meet such cases by special services, in the evenings, and on afternoons of the Lord's-day. In some cases it may be found desirable to organize a separate Sunday-school.

It is proper that every community should bear the cost of its own church-building. If the people are not able to build a fine house, let them build a plain one; only, let them see to it that they do not practice economy in religion to the degree of niggardliness. But in a new country there will be many instances in which the immediate wants of a community demand a better house than their means will enable them to build. In such cases heavy debts are often incurred. These are swelled from year to year, by accruing interest, until the burden becomes intolerable, and is felt as an incubus upon all the interests of the cause. If there were a fund from which loans could be made in such cases—loans that should not bear interest—it would be a great relief. A sum that would otherwise have to be paid in interest, securing no reduction of the debt, could be easily raised from year to year, and in a few years the debt itself would be extinguished.

Has not the time fully come when the Methodist Episcopal Church, South, should have a Church Extension Fund? Many churches are greatly embarrassed from the want of a little timely aid.

Let us see how such a fund would relieve a struggling society. A community is greatly in need of a church, and its condition requires a church that will cost not less than

three thousand dollars: an exhaustive effort is made, and *two* thousand dollars are subscribed; this is the limit—nothing more can be done at present. After painful deliberation, the trustees resolve to build such a house as will answer the demand. The house is built. At the time of dedication, five hundred dollars of additional subscription is obtained; but four hundred of the original subscription has never been collected, and one hundred of this last will not be—so the debt is one thousand dollars. Money is borrowed at ten per cent.; it runs on four or five years; the interest is paid by reluctant subscriptions—reluctant, for the subscribers know that the debt remains all the same; after a time the principal must be paid. Every contributor is in bad humor, for he has been worried every year for money to pay this debt. Or, suppose the interest has not been paid, but has been compounded every year: at the end of five years it has run up to over sixteen hundred dollars; or if it runs on eight years, it is more than doubled. Now, if there had been a fund out of which one thousand dollars could have been advanced to them, without interest, on condition that they should repay it in five annual installments, at the end of the five years their debt would have been paid, and the money that afforded them such important relief would be in use again, aiding feeble churches in other places.

The work of Church extension and that of domestic missions must go hand in hand. There will always be regions, thinly inhabited by people of limited means, that must be supplied with the means of grace through the generosity of the Church. This is a god-like work, and happy is that Church which enters into it most fully and earnestly.

I forbear to enter upon a discussion of that feature of the work which may be peculiar to the cities. In those cities where there is a homogeneous American population the situation is hopeful; but where great cities are filled up with masses of foreigners, who either despise religion, or are Romanists, or formalists of some other type, with whom the Sabbath of the Lord is a day not only of recreation, but of dissipation, the prospect is gloomy, and the question one of Missionary enterprise rather than of Church extension.

One thing is evident, and must not be overlooked: God must be honored more largely by the Church in one particular than he has yet been, before either the world can be converted or even Christian countries brought fully under the influence of the gospel. Here and there a man in the Church measures up to the true standard in this respect, but the great mass of those who profess to be followers of Christ seem to have little or no conception of either their duty or privilege. What I mean is the consecration of money to God. The revenues of the Church are altogether inadequate. There must be a wide awakening of the Christian conscience on this subject before the Church can fully occupy the land. Men must have an enlightened consciousness of the fact that both themselves and their property belong absolutely to God.

BUILDING.

UNDER this general heading a few practical suggestions are made, which may be of service to those who are, or ought to be, concerned in the building interests of the Church. Many persons fail to realize the extent to which they are involved in the responsibility of advancing these interests, and therefore give to them but little or no thought, encouragement, and material support; and not unfrequently is it the case that where sufficient willingness and zeal are found, the absence of both esthetic taste and practical knowledge detracts from the efficiency of well-intended effort and the amount of good sought to be accomplished. There is need of cultivation and improvement in this respect, in both the ministry and the laity.

The point last stated, however, has been disputed by some, it being contended that such matters belong not to "preachers and people," but should be committed exclusively to the architects, to "have their own way." One writer says (of the "preachers and people"), "They may occasionally construct a square wooden box, and call it a church, and which serves its purpose very well; but such a structure has no more relation to architecture, as an art, than a common goods-box;" and hence, he argues, it is not an appropriate subject for discussion in a religious journal. But the force of this argument is against the position he has taken. If a large majority of the church-buildings in the United States, which, according to the last census, number sixty-two thousand, five hundred, and twenty-two, have been erected without the aid of an architect, which we are justified in assuming —or, to take his own denomination, if a majority of the twenty-eight thousand Methodist churches in America (making an average of nearly one church for every day in the past century) have been built without bearing any "more relation to architecture, as an art, than a common goods-box"—there does appear some propriety in an effort being made by the "preachers and people" to increase their stock of information concerning such work.

If each denomination of Christians had its own architects, and an architecture suited to the genius of its own doctrines, institutions, and usages, and could secure a uniform observance of their prescribed models, there would be less demand for a general elevation of architectural taste and diffusion of practical architectural knowledge. But so long as the preachers and people are to be, in the majority of cases, their own architects and builders, and will not commit these matters to professional artists, to "have their way," they should be in possession of such information as is necessary to a correct conception and successful prosecution of these important enterprises.

Those who have the least idea of architecture, either as a science or an applied art, appreciate it least in its relation to the worship of God and the preaching of the gospel, or as having a refining and elevating influence on the human mind, and are, therefore, least inclined to avail themselves of the advantages of the professional study and skill of others. They have to be aroused to the importance of the subject in hand before consenting to adopt such measures as will secure appropriate design and proper construction in their houses of worship. This end can be reached most successfully through the religious journals of the Church, whose circulation extends to all classes, and whose object is to advance both the material and spiritual interests of the Redeemer's kingdom. And while the merits of the general subject are there presented, and a spirit of enterprise is thus developed among the people, it is appropriate that plans and instruction for specific work be put into the more permanent and convenient form of a book, which can be used by any individual or building committee in selecting the design for a house, and by the mechanic in building what has been selected.

The commission has been given, "Go ye into all the world, and preach the gospel to every creature." One great facility for carrying out this commission is the bringing the people together in one place to hear the divine message. This is not only an important measure for gaining access to the unconverted in order to persuade them to accept salvation, but, according to the exhortation of the Apostle Paul to the Hebrews, it is also an efficient means to the growth and perfection of Christian character. Those who have already become the disciples of Christ are not to forsake the assembling of themselves together. The gathering of the people for these purposes must be at regularly-appointed times and places; besides, ample and suitable provision is to be made for their protection and comfort while thus assembled. In pioneer work, it is generally necessary for the minister to serve his congregation in some private house; and this is well—for, in multiplied instances, the great Head of the Church has signally crowned and blessed such labors with the outpouring of his Spirit upon entire communities. But, as soon as practicable, it is best that public and permanent buildings be erected and set apart specially for the public worship of God. In the responsibility of providing appropriate houses for this purpose, as well as in the benefits to be derived from their presence in a community, every member of that community is involved, for the ends to which they look are the peace and blessing of society, and the elevating and saving the human race.

"Churches are built on many different plans, and have been so at all periods; one plan has no more authority than another; it is entirely a matter of convenience and decent order. The earliest churches were chambers in the houses of the more wealthy Christians, who allowed their poorer brethren to assemble in their houses, usually in the hall or largest room, but at first in small rooms, either at the top of the house, as mentioned in the book of The Acts of the Apostles, or in the chambers below the level of the street, which were usual in the houses, or palaces, of the Roman nobility. Several of these subterranean churches remain, as St. Pudentiana, St. Clement, St. Sylvester. In all these cases other chambers were built above them for churches, after the peace in the time of Constantine. At Rome, the seven great churches made by Constantine, which still retain the name of basilica in an especial manner, were probably all originally law-courts, and

preserved their old arrangements, which served as types for others, and came to be considered the usual arrangement of a church." * The basilica, which was a public hall, either of justice, exchange, or other business, was usually of rectangular shape, separated into nave and aisles by rows of columns, sometimes with transepts, and with an apse, or semicircular recess, at the end. Where these halls were used as law-courts, or halls of justice, the seat of the judges was in the recess against the wall, the tribunal immediately before them, and an altar for administering oaths directly in front of the tribunal. This arrangement was chosen because convenient and appropriate for the business to be transacted.

Some of the features of the basilica are well adapted to the purposes of a church, having the double recommendation of utility and beauty. The support of the roof, or ceiling, by columns, and the division of the ground-plan into nave and aisles,† can be dispensed with to advantage. Transepts are not objectionable, except as they may add to the cost. Dropping the ancient name, the recess at the middle of the end wall is a desirable appendage to a church. This feature of the basilica was adopted throughout Europe, especially in France, Germany, and Italy. Early in the Norman period of architecture, English architects began to dispense with the recess, making the end of the house square. Its use, however, was afterward revived, in the change of architecture, and its advantages continued to be recognized through succeeding centuries. This arrangement should not be considered as belonging exclusively to any particular style of architecture. As its advantages are real, and not imaginary—as they pertain to utility as well as beauty—there need be no hesitancy in incorporating it into the design of any house of worship. It does not militate against the acoustic property of an audience-room, as some suppose; for there are examples of the greatest success in this respect, where the pulpit recess is used.‡ It affords the means of introducing light to the pulpit without unpleasantly affecting the sight of the congregation. It gives space for additional seats in front of the altar. These points are worthy of notice, to say nothing of the improved appearance it gives above that of a plain wall. Its chances for impairing the speaking or hearing property of a room are on the same basis as the room itself. Proper rules of construction must be observed in the one case as well as in the other. A recess with straight lines and angles is preferable to one that is round.

The general outline of this form is that almost universally adopted, the width being usually from one-half to three-fourths the length. It has been thought to combine more of the requisites of a place of worship than any other form, allowing those arrangements which accommodate most perfectly the services of the sanctuary. An architect in the city of New York, Lawrence B. Valk, proposes a change in this form and the common arrangement of church-buildings, claiming for what he terms the "new form" the merits of an invention. He gives the following description of one of his models, the "Church of the Disciples," New York, which is one hundred and twenty-five feet square, and cost one hundred and twenty thousand dollars: "This church has the largest audience-room in this country, arranged on the new form of plan in the seating and arrangement of the aisles.

* "Parker's Glossary of Architecture." † Body and wings. ‡ This is true in Church Design No. 10, the arrangement of which is shown in Fig. 38.

The main points are perfect acoustics, perfect ventilation, and the greatest amount of comfort. This vast audience-room seats two thousand four hundred on the floor—no galleries; the floor pitches from front to platform six feet, enabling all sitting behind each other to see over the heads of those in front. The ceiling, forty feet from the floor, is level, and divided into panels by heavy ribs of wood. It is lighted by the new arrangement of reflectors,* and at night, as well as in the day-time, there is a remarkably cheerful look to the whole place. It is without a column or obstruction of any kind, and its acoustic property is so good that the lowest tone of the voice is distinctly heard anywhere." Mr. Valk has another design for a church, making the audience-room one hundred by one hundred and fifty feet, the pulpit being at the middle of the side, and the seats all circular with the pulpit as focus.

Another point strongly urged by this architect, as important in church-building, is the use of iron in the construction. He uses it on the inside for ceiling and walls, on the outside for walls and roofing. His experience in this sort of construction, he says, establishes the fact "that congregations or societies of limited means can obtain beautiful, and even elaborate, designs in iron for one-half the cost of brick or stone, to say nothing of the saving of time in erecting, and the space gained in a lessened thickness of walls." The corrugated, or ridged, surface on the inside of an auditorium, he thinks, contributes to the ease of the speaker, and gives good effect to music. No difficulty is met in heating.

The above is a plausible presentation of the advantages of iron in the construction of edifices for public worship; but the present writer has not in his possession the facts and figures to justify an unreserved indorsement of all that is proposed. Farther investigation may satisfy all questions touching this point.

Whatever prominence may be given to the style and contour of the exterior of a church-edifice, it should be considered of still greater moment to secure an appropriate arrangement and finish of the interior. It is not meant that the former may be neglected, but that the latter should be invariably secured. No intelligent congregation of worshipers will be content with a mere protection from the weather, when it is known that they might have a convenient, comfortable, and pleasant place of worship. Bodily discomfort, induced by ill-shaped seats, poor light, and worse air—to say nothing of other defects in arrangement combining their influence with these—distracts the mind, counteracts the effects designed to be produced by the preaching of the gospel, and lessens the attractiveness of the house of God. Such mortifying of the flesh is no part of Christian duty, as some seem to believe; for it cannot be productive of any good. Indeed, the fewest number will be found devout and self-sacrificing enough, with such experience, to be able to say, with the Psalmist, "I was *glad* when they said unto me, Let us go into the house of the Lord;" and they are even less likely to say, after an hour's trial of it, "I will dwell in the house of the Lord forever" (*i. e.*, *that* house). The minister will find himself hindered in his earnest and laborious efforts for the building up of his congregation, "the edifying of the church," and the salvation of souls; for the stay in the sanctuary must be at least comfortable to contribute most to the Christian's enjoyment of public worship, and the

*Similar to Fig. 21 of Church Design No. 5.

most successfully to draw the imperiled in from "the cataracts of perdition thundering near." This comfortableness comes not by accident, but at an *expense* of thought, effort, and money.

Economy, both as a business principle and religious duty, is never to be lost sight of in church-building. This is the more imperative on account of the difficulty of obtaining a sufficiency of funds to meet fully the demands of the case. But we are not to understand that economy means stinginess. Its definition, as given by Mr. Webster, is "frugality in the necessary expenditure of money," the spending of money judiciously and to advantage. There is no little danger of withholding from the wrong thing, and of exhausting the treasury in favor of that which is of less consequence. Great perplexity is often experienced at this point, to use to the best advantage the means contributed to the cause of church-building. The very best judgment is required to begin well and end well; and a right beginning is no small part of the struggle. The foundation of the enterprise is laid by reaching an intelligent conclusion as to what *ought* to be done—what size, character, and cost of house will best advance the interests involved; and then bring to bear upon its consummation all influences and energies possible. Before we can make our purposes intelligible to others, and claim their coöperation, we must understand well what is before us—what definite end is to be attained—and not forget that a noble undertaking will meet with a noble response from those to whom we look for support. A good plan, with the necessary specifications, should therefore be obtained in every instance. Such a course will not only inspire confidence and elicit aid, but prevent blunders and disappointments. It is not economy to withhold money here, and work in the dark. The present writer can cite cases of expensive mistakes in this respect. Twenty-five dollars was considered too great an outlay for the necessary plans of a church to cost ten thousand dollars, yet at least one thousand dollars were expended not only unnecessarily, but to the serious detriment of the building. Ten dollars could not be given for the plans of another church, yet nearly that amount was paid for remodeling a door, the size of which had not been correctly *guessed*. Many other instances of this kind could be mentioned. The object of the present volume is to prevent these expensive and unpleasant results, by furnishing plans for work at a comparatively trifling cost.

The architectural character of our churches should be improved. There is a positive and increasing demand for this—a demand which cannot be disregarded on the plea that it incurs additional expense, or that it begets pride. Experience teaches that, as a general rule, it costs more to build unsightly and inconvenient houses than those of a higher order of utility and beauty. It will require the investment of a few more dollars, but the required sum can be more readily raised for an object that accords with the ideas and taste of an enlightened community, and promises a satisfactory issue, than can be done for perpetuating the "goods-box" style, which subjects both preacher and people to inconvenience, and not unfrequently to just reproach. Besides, a church simple in its adornments, but designed with judgment and taste, will gratify a laudable self-respect and tend to intellectual and spiritual enjoyment, rather than encourage and develop pride. Nor can it be established that the *poor* are excluded from the services of the sanctuary on account of the house of worship being built in elegant style. No denomination has a greater number of

this class of communicants than the Catholics, and yet their churches, especially in large cities, are generally more costly and more extravagantly ornamented than any others.

The arguments for an advance in ecclesiastical architecture are substantial and irresistible. It has been well said by some writer that "the subject of church architecture runs down to the deepest questions of doctrine and life, and is not so trivial as may at first thought be supposed. We must have a church architecture which is a true expression of Protestant life; and the best way to attain this is to be true to the Protestant spirit, and to make it the first requisite in church-building that the wants of the worshipers be fully met."

The Rev. Dr. Summers says: "There should be a due regard to architectural beauty. The house of worship should be an attractive place. There should be no extravagance in ornamentation, but there should be no violation of the recognized principles of architecture." The observance of this general rule would be a decided advance in some localities, and would give us "sanctuaries which can be easily distinguished from cotton-mills, warehouses, and railway stations. Indeed, it is not a healthy sign of public sentiment and feeling where noble and attractive buildings are devoted to commerce and amusement, to science and literature, while bald and repulsive buildings are given to the worship of God."* But the beautiful is never to be indulged to the extent of its becoming an expense to the useful. The two should exist in harmony and be duly proportioned, so that in design and construction, and indeed in every material and spiritual point of view, the sanctuary of the Most High may impress the worshiper, and even the careless observer, with its harmony and completeness in itself and all its appointments.

"It is a sign of religious progress when a Church exhibits in happy combination the characteristics of earnest, intelligent, spiritual teaching, and of chastened beauty in its religious edifices, and in the forms and observances of religious worship; when its congregations assemble, Sunday after Sunday, to listen to a style of religious instruction which feeds their minds, kindles their aspirations, elevates their whole nature by the power of spiritual thought, while at the same time the very fabric in which they meet, in whose fair and stately form art has dedicated its highest efforts to the service of religion, and the pathos and sweetness of their songs of praise, and the reverential propriety of their whole order of worship, lend to thought and instruction all the aid which sense and feeling can contribute. The former is indeed the higher and more important element of our religious services. Better, a thousand times better, the homeliest fabric and a ritual bare to ruggedness, if the teaching be pervaded by manly Christian intelligence, and the fire of fervent piety prompt the sounds which grate on the ear of taste, than a place of worship where the senses are fed and the spirit starved, where the music is fine and the preaching poor and shallow. But there is no divinity in ugliness and discordance, no essential connection, but the reverse, between religion and deformity."†

Special attention is due this subject in its relation to the Church's operations in new communities. The article of Bishop Marvin on "Church Extension" is full of excellent thoughts on this department of Christian offering and effort, and is well calculated to

* London Recorder. † Prof. John Caird.

inspire the reader with a missionary spirit. The following remarks of the Rev. Dr. Everts are pertinent and forcible:

"In order to make public worship universal, churches must be provided early and with attractive appointments, in growing suburbs of cities, and in new territories. Church-building should be a principal measure of evangelization, of pioneer and home missions. Funds raised in older States and communities should be liberally expended, through some comprehensive plan and fund for church-building, in early securing sites and furnishing limited assistance in erecting chapels. By such forecast and economy the papacy procures immense establishments for church and school, in all new towns, territories, and states. In this way foreign aid multiplies indefinitely local contribution and investment, and most effectually secures the observance of the Christian Sabbath. The contributions and sacrifices of a people in building a house of worship more surely pledge their attendance and support than ecclesiastical authority or devotion to a creed. Houses built by the State attract small assemblies; those built by voluntary contributions are filled with worshipers. Those building their own chapels require little foreign aid in supporting pastors. Congregations gathered without a fixed place of worship by long years of missionary service have been dispersed, and the fields they occupied given over to more sagacious enterprise. In location, style, and expense, these buildings should be a fair exponent of the wealth and taste of the community. Religion may demand the first-fruits of art as well as of fields and flocks. A rude stone altar might prove the devotion of uncultured ages and nomadic tribes; but, with improved taste in the habitations of men, the house of God must be magnified. A cheap chapel in a rich community attests poverty of religious sentiment, and must be as offensive as offerings of the lame, halt, and blind of the flock, or blasted fruits of the field, in the ancient temple. The most expensive house a people will pay for may do more to promote charity and piety than to foster vanity and pride. Parsimony and avarice in a people are far more to be dreaded than extravagance in church-building. The alabaster-box broken and poured upon the Saviour's feet, though begrudged by a grasping covetousness, was accepted as a fragrant memorial of devotion. So an elegant chapel, though condemned by a coarse and covetous spirit, may promote public worship and the honor of Christ. Those most deprecating expenditure in church-building are not found most liberal in support of missions or in provision for the poor. The erection or repair of a church has often reclaimed an entire district from Sabbath-breaking to religious observance and moral life. Travelers predict the downfall of Paganism and Islamism from the neglect and dilapidation of pagodas and mosques, and the decline of Christianity will be imminent upon the decay of her churches. The rule of Christianity will not extend beyond the spread of her chapels and ingathering of her congregations."

It must be admitted that the character of our houses of worship concerns in a great degree the success and prosperity of the Church. Our present object is to give emphasis to this point, so that while we encourage the erection of new churches wherever needed, we also recommend a course that will secure to them generally a more respectable and commanding appearance without, a more accommodating arrangement within, and such a cheerful and inviting air as should always characterize the place of divine worship. The steps necessary to this end are severally considered in the following pages.

THE PASTOR'S RELATION TO CHURCH-BUILDING.

ALL the affairs of each local church are committed to the oversight of the pastor. His accountability in the matter is explicit and rigid. The examination of character through which he must pass, and the reports he is required to make, will show whether or not he has been faithful to his trust. If he is imbued with the spirit of his high calling, he will be active and aggressive, and cannot be content to remain indifferent to any issue involving the welfare of his charge. If he sees that his people are discomforted, and likely to be depleted, on account of having to worship in an inconvenient, unsightly, dilapidated house, he should seek at once to remedy the evil by substituting a new and better house—one calculated to *attract* the people, and aid them in their intelligent and fervent worship. He cannot always wait for a voluntary movement in this direction by his people, unless they are very prompt, but must initiate the necessary measures himself. He is expected to be a competent leader, a wise counselor, and a ready worker, in getting up these enterprises and bringing them to a successful termination. Therefore, on the score of duty to extend the kingdom of Christ, the pastor is bound to give his attention to this subject; but he is also personally and specially interested in the results—*i. e.*, in reference to his own good. It is well known to be much more laborious and exhaustive to speak in some houses than others. The extent of this difference, however, and the actual effect on the speaker, caused by the particular shape and arrangement of the house, are not always fully appreciated, even by the sufferer himself. He has preached in other places with greater ease to himself and more benefit to his congregation, and wonders why his labors at his present post are so rapidly wearing him away. And he is the more likely to be deceived as to the cause of this trouble, in consideration that his present church is much less than others where he has preached before. A room thirty by forty feet may be more injurious to the speaker than one twice that size. The pastor, therefore, owes it to himself, and to his brethren in the ministry, to see that the houses erected under his supervision are so constructed as not unnecessarily to tax the preacher's energies, burden his life, and shorten his days.

The pastor is not expected to constitute the building committee himself, but to see that it is composed of his very best men. Working with them intelligently, diligently, and prudently, proper and satisfactory results may be reached in every instance. But there are times when he must be prominent in this work, where there are no others to prosecute it; and, although laborious and trying, he must not shrink from the responsibility, but take courage and comfort from the fact that he is laboring for the good of the Church, and especially the Church of the future. To be successful in this department of his duties, he must, as in preaching the gospel, "*study* to show himself approved unto God, a workman that needeth not to be ashamed."

BUILDING COMMITTEE.

WHERE a church-building is contemplated, it is necessary to have "a judicious committee of at least three members of our Church," who are authorized to take under their immediate supervision the proposed work. Assisted by the counsel and coöperation of the preacher in charge, and acting in accordance with the instructions of the Quarterly Conference and the regulations of the Discipline, they are to begin and carry to completion the enterprise intrusted to them. The duties devolving upon this committee require that they be "*judicious*" men. They are expected to ascertain what the society and community *need*, what size, style, and cost of house they *ought to have*, and what the probabilities are of obtaining it. A suitable plan, with the necessary specifications, is to be procured by them. This is essential, not only to the faithful performance by the workman of what is required of him, but also to the agreement of the committee among themselves as to what they propose to do. This is important work—foundation work—on which depends largely the success of the enterprise. Without an intelligent and definite outline of the project before them, they cannot proceed with satisfaction or safety. The neglect of duty at this point opens the way for many difficulties to spring up. It is to jeopardize the interests of the Church, therefore, to commit them to those unacquainted with the principles of architecture and inexperienced in building, when they are disinclined to seek any benefit from the study, skill, and taste of those who have given their attention to this subject. "As long as men consider the arts of designing and constructing buildings to be of no special importance, or that they themselves are qualified, without instruction or experience, to practice them, expensive blunders will naturally result; and sooner or later it will be discovered that such wisdom is dearly bought. There are many, however, who prefer to manage their building affairs in this way, and who can learn more agreeable and *less expensive* modes only by actual experience. Some do it from ignorance, some from *supposed* economy, and others from the supposition that they are the best qualified." * An outlay of a few dollars at the beginning, in order to start right, will certainly show better ideas of economy than to create the necessity of spending hundreds afterward to correct errors. Should any one consider it a reflection upon his architectural taste or building and business capacity to defer to the acknowledged competency and superior judgment of others, he may be assured that this course will be far more creditable to him in the end than for his work to result in the disappointment of the community, and be the cause of perpetual regret to all concerned.

On this committee devolves the duty of selecting the location, and also of raising funds to carry forward the work. The latter will constitute no small part of their labors, and every scheme looking to this end should be sanctioned by them before being put into operation. Having ascertained the amount necessary to put up the building, they are to secure by reliable subscription three-fourths of this amount before beginning to build. The effect of this rule is to prevent the incurring of debt; for, with such a commencement, the last fourth of the money may be easily secured by the time it is needed. Due attention,

*George E. Woodward.

therefore, to these interests, and their successful management, require that the committee be men of practical business capacity, qualified to transact safely and accurately all business pertaining to the enterprise, acquainted with the quality and value of materials, knowing how to direct labor to the best advantage, competent to detect any slight of the work or wrong execution of details by such mechanics as aim only to make their work "pass muster" with their employer. These men should be conscientiously devoted to the Church, so that they will look after its interests at least as promptly and carefully as they would their own affairs. It will be well if they possess a good stock of patience and forbearance; for the work will not always progress as rapidly and satisfactorily as they desire; besides, they will often encounter conflicting opinions and interests, have to harmonize the differences that may arise among themselves, and bear the criticisms of the selfish and self-important.

Every action and transaction of the committee should be, as far as possible, in accordance with strict business rules. It is better that all contracts be written, and every item clearly and fully stated, so as to prevent misunderstanding between parties, and to save the work from damage and the Church from unwarranted expense. Confidence in the judgment and integrity of each other, or of any person employed, is no excuse for carelessness or laxity in the discharge of this sacred trust. This course is contemplated by the Church, and the community at large expects it. It is therefore necessary that the committee, at the outset, effect a permanent organization by the election of a chairman, secretary, and treasurer, each having his duties clearly defined. They are then prepared to proceed regularly with the work, every step taken being sanctioned by vote of the committee and recorded by the secretary. The treasurer should keep a list of the names of all subscribers and the amounts subscribed. He should receive all funds collected, and pay out all moneys to be paid, keeping a full and accurate account of the same, including material and labor given, as well as cash, and giving each individual credit for his contribution by associating his name with the entries in this account. All bills should be paid by him, they having been first indorsed as correct by either the chairman or secretary, as may be agreed upon, or by any one appointed to superintend the work; and no bill should be indorsed until the material or work for which the charge is made has been inspected and accepted by the committee or their authorized representative. These bills, when paid, should be invariably receipted, and then kept by the treasurer as vouchers for his entries of money paid out. In this way his books will show at all times the exact financial *status* of the concern: what has been received, and from whom; how much has been expended, and for what; the amount remaining in the treasury, and also the subscriptions yet uncollected.

The expenditures should not exceed the receipts, which can occur only by individual advances, and these advances should be first sanctioned by vote of the committee. Nor should any liability be incurred beyond the actual resources of the Church, unless the committee assume it as individuals, to protect the Church from any embarrassment which those holding the claims might be disposed or compelled to throw around it. This plan of procedure may appear to some too tedious and exacting, but it is the only plan that will insure correctness, safety, harmony, and a result satisfactory to all. The congregation, with hearts glad and free, can then enter unhindered upon a delightful and useful career.

WHERE TO BUILD.

THE reader is referred to the article by Bishop Marvin on "Church Extension," which contains valuable suggestions as to the extent to which we should multiply the number of our church-edifices, and where the limit to this multiplication is to be found. While every field demands our occupancy, we must not be led into the mistake of decreasing the strength and influence of the Church by having our houses too near together. Bearing in mind the suggestions of the Bishop, attention is here called to the selection of the site, or immediate spot, on which the house is to stand.

The choice of an appropriate site is of greater consequence to the growth and prosperity of the Church than many seem to apprehend. A good site is essential to any public building, but especially to a church; for many of those intended to be reached through the preaching of the word and benefited by the services of the sanctuary, are but little inclined to encounter difficulties and make sacrifices to attend the house of God. They feel free to remain at home, or go elsewhere, as may best suit their inclination and convenience. Hence, the church should be accessible and inviting in its situation.

It is not unfrequently the case that those acting for the Church, instead of *selecting* a place, merely *accept* the first one that is offered in answer to the question which they send out through the community, "Who will give us a lot?" Sometimes the place designated has but little or no fitness for the purposes intended. In this way the efforts to spread the gospel and extend the Redeemer's cause are subjected to serious disadvantages, and deprived of the efficiency and success they would otherwise have. After such mistakes have been made, but when the time for remedy has passed, the projectors of the enterprise will find that others, of better judgment and more sagacity, have come in, even at a later date, selected the more desirable locations, erected their houses, gathered the people into their congregation and communion, and brought the children of the community under their training and influence in the Sunday-school.

The individual who gives a lot or tract of land on which to build a church deserves credit, especially if he thus gives to the Lord the best he has, but deserves no more than he who gives the same value in something else. We lose sight of this fact, and think we *must* build on the lot given; and if the giver offers choice of many lots, we feel under obligation to take the poorest one of all—the one least valuable to him, but, as we seem to think, good enough for a church. There is, however, in reality no obligation to build on any lot, by whomsoever given, that is not the right sort and in the right place. It would be better to take the cash contributed by some one else and *buy* a better lot—one that will inure to the present and future good of the Church. There will be nothing lost by this course, even though the donor of said lot cannot give any thing else in its stead; for the purchase of a good site will inspire public confidence and interest, and elicit larger contributions from the people, and more of them, than a poor, out-of-the-way place would command. It may be said, then, that a choice site at a reasonable price is far preferable to a poor one as a gift; for a good lot in a good locality will generally secure the erection of

a good house, and then bring a good congregation to worship in it. This will be found true especially in our large cities.

Another difficulty met in selecting the best site arises from personal preference and interest. It is a fact, and certainly not a creditable one, that congregations are sometimes compelled to worship for years in an old, dingy, gloomy, disfigured, dilapidated, crumbling house, merely because the individual opinions and preferences of parties interested cannot be harmonized or subordinated to the general good. An intelligent committee, with Zion's prosperity at heart, and after a deliberate, conscientious, and disinterested investigation of the subject in all its bearings, will be able and willing to harmonize upon a plan for improvement, and put it at once into operation. Perfect harmony of feeling and action should, if possible, be secured; but the cause of God and the work of saving the souls of men should not be held in check by the disaffection of any individual.

A few considerations are presented here to aid in determining where to erect a church-edifice.

I. A house of public worship should be located with reference to *accessibility*, calculation being made, as far as possible, on changes to take place with the population in the future. Its appropriate place is in the midst of the homes of the people, convenient to the aged and the young, and offering inducement to the indifferent. If in a city, it should be sufficiently removed from the busy streets of trade and noisy thoroughfares of travel, so that, at any time the congregation may assemble, they will not be disturbed in their worship. It is desirable to be near a means of public conveyance, so as to be accessible even to those who live at a distance, and have no private conveyance; but it is unpleasant, and unfavorable to devotional feeling, to hear the rumbling wheels of a street-car or ringing-bell of a locomotive, passing the church-door every few minutes, drowning the minister's voice, or introducing discordant and distracting sounds into the hymns of praise and sweet music of the place.

II. The *character* of the site itself demands careful consideration and thoughtful choice. In the first place, the plot of ground should be ample in size to accommodate all the arrangements and conveniences that pertain to the place of the people's assembling for public worship. In cities such a site is more difficult to be obtained than in the country, yet it can generally be had. The lot should be large enough to allow admission of light and air from all sides. It should admit of the building being set back not less than twenty, nor more than forty, feet from the street. And when the yard has been neatly fenced, and the necessary walks of brick or gravel made, the space in front and at the sides may be tastefully ornamented with grass, flowers, shrubbery, and evergreen vines and trees. This ornamentation of a city church-yard is eminently appropriate; and while it will cost the members of the Society a *little* work, a *little* attention, and a *very little* money, it will yield an ample compensation in investing the place with a sweet and pleasant air, and in producing results exceedingly gratifying to all. In the country, the lot should be selected so as to place the house a few rods from the road, on a gentle eminence, shielded from the piercing winds of winter and pitiless heat of summer by the drooping boughs of grand old trees, and with such other surroundings as will make it an attractive and delightful spot. It is expected that every church in the country will have sufficient grounds for a grave-

yard. Every community must have a common burial-ground for their dead, and there is no place more appropriate for this than near the church. And the community that will not neatly fence and keep in order this burial-place, say plainly by their actions that they have but little respect for themselves or for the memory of the dead, whom, with tears and sobs, they have buried out of their sight. Again: the site must be elevated, especially in cities. This gives it a natural drainage (the only sort many churches get), running the water away from the house, and keeping the grounds free from mud. The general view *of* such a site, and the view *from* it, will be far more pleasing and impressive than if it were low. The church becomes not only a prominent building, but a landmark for the people, and on this account is more frequently seen, spoken of, and visited. Besides attracting attention in this manner by its situation, the clear notes of its bell will ring out unobstructed over the neighborhood, calling together devout worshipers of the Most High, and serving as a faithful reminder to the most careless and wayward that there is a God, a Sabbath, and a call to duty and accountability.

It is thought preferable to select a site that will front the house to the south. The regular services in our churches are held about the middle of the day and after sunset. This arrangement will prevent an excess of light and heat from the sun coming through the side windows during the midday service. It will shut out the cold north wind of winter, and admit freely the cooling breeze of summer.

We say, then, that "the church, in its site, and by its arrangement and surroundings, ought to be as attractive and pleasant as any other place about it. It should speak a welcome by its very look, as well as by the sound of its bell. It should have a position at once so commanding and attractive, characterized by such breadth and generosity, and imbued with such architectural expression, as not to suffer by comparison with any other buildings in its vicinity."*

WHAT TO BUILD; OR, ADOPTING A PLAN.

Among the points worthy of consideration in adopting a plan for a church are the *dimensions*, *proportions*, *arrangements*, *style of architecture*, and the *cost*. These must receive careful attention before any definite plan can be determined upon; and when thus adopted, it ought to be so complete as not to require any changes, either during the progress of the work or after it is finished; for changes are usually expensive, and not unfrequently disfigure the house. The best policy is, therefore, to obtain at the outset a clear conception of *all the ends to be subserved by the building*. Factories, stores, and residences are built with reference to their intended uses; so it must be with the church.

*Congregational Board of Publication.

DIMENSIONS.—Except where a congregation is already established, the seating capacity of a permanent church-edifice must be determined with some reference to future, as well as present, demands. The probable increase of population, or any other change likely to take place, deserves consideration. When the congregation can be made sufficiently large to require the undivided service of an efficient minister, and have sufficient financial ability to support him in his work, the size of a building in such locality should be determined accordingly. It is not wise to have too much empty space in a church. A congregation cannot afford to provide extra sittings to be occupied only once in five or ten years, on some extraordinary occasion. There must be ample room to accommodate the congregation when full-grown, and but little more.

Were it required to specify a certain number of sittings as a limit to our churches, *five hundred* would be the number recommended as large enough for any of them; for this number will fully engage all the intellectual resources and physical energies, the entire pulpit-effort and pastoral care, of any minister who does justice to his profession, his family, and himself. Looking to the benefit of the people, this is not setting "metes and bounds" to the ministry of the word, nor excluding any from the privileges and advantages of public worship; but the policy would secure to the people more pastoral attention and better religious culture and training, give piety a stronger and more manifest hold on the hearts and lives of those who profess it, and make the experience of the religious more joyous and their labors more efficient, than is often realized in our overgrown societies. It would give life and activity to existing organizations, beget a missionary spirit, and awaken such an interest in Church extension as would provide houses of worship in unoccupied territory, and send the gospel to the destitute. In this way the full resources of labor and means of each Church may be brought out and made available for good.

And on the other hand, in its application to the minister, this limit must also be observed. The shepherd owes a duty to each member of his flock; and, as a general rule, he cannot render that service to a greater number than that which has been mentioned. Besides, he should not be expected to fill with his voice a much larger space, especially if partly vacant, than would seat the designated number. The average human voice will not reach more than eighty feet. "Men of lungs, like Beecher and Spurgeon, may fill larger areas; though Storrs said of Beecher that he had wasted voice enough in thirty years to make two respectable-sized thunder-storms! It may be so. But churches are not usually built for 'sons of thunder;' regard is had, in their structure, to average lungs and average ears. It is folly so to increase the size of an audience-room that the speaker must bawl himself hoarse to fill it, and the listener be obliged to keep attention upon a perpetual rack and strain to hear. Better two smaller churches, than one which no ordinary preacher can satisfactorily fill."* The people will then be better served, and the preacher himself preserved.

Most persons over-estimate the seating capacity of a house. A house already built can be estimated by counting the seats or persons in it; but to ascertain the number of

*Dr. Wentworth, in the *Repository*.

persons that any proposed building will seat, some general rule must be followed. The amount of space occupied by a given number of pews, and also the amount taken up by pulpit, altar, aisles, etc., will vary in different instances—those who kneel to pray will require the pews to be farther separated than those who stand, etc.; but, as *a rule for general measurement*, the following is the most simple and satisfactory that can be adopted: *The length of a given room (inside), multiplied by its width, and the product divided by seven* (7), *will give the number of regular sittings in that room.* By this rule, a house 35 by 50 feet has 250 sittings; an audience-room 40 by 61 feet will seat 350, and one 50 by 70 feet in size will seat 500. No allowance is here made for extra seats introduced on special occasions, nor an unusual crowding of persons together, nor yet for any extra space required to preserve the equanimity of such church-goers as "make broad their phylacteries and enlarge the borders of their garments." Calculation must be made for these outside of the rule. In church-building, therefore, seven (7) square feet of space on the floor must be provided to seat comfortably each adult member of the audience. Although this may show that, in some communities, there is less church-going than has been thought, and that some preachers have been addressing smaller audiences than they were aware of, yet it seems to be a correct *general rule*, and is supported by the plans of our best architects.*

PROPORTIONS.—We cannot afford to be indifferent as to the proportions of our audience-rooms. Without discussing the subject in this connection, it may be accepted as a safe *general rule* that, taking into account the strength and beauty of the building itself, and also the effect upon speaking, hearing, and seeing, *the width should be three-fifths* ($\frac{3}{5}$) *the length, and the height one-half* ($\frac{1}{2}$) *the width; provided, no ceiling shall be less than fourteen* (14) *feet high, and where the width is thirty* (30) *feet, the height shall not be less than sixteen* (16) *feet*, inside measurement. It is not absolutely necessary to follow this rule in all respects, but it is safest to do so. Its merits will be considered again under the section on Acoustics.

ARRANGEMENTS.—Provision is to be made for the various services we are accustomed to conduct in the house of God. Whatever stress may be placed on other parts of public worship, none can be more prominent than the preaching of the word. There will be required, therefore, an ample and well-adapted AUDIENCE-ROOM, whether any other apartments can be provided or not. This, however, will be equally suited to the other parts of worship usually connected with the preaching, and may be used, in case of necessity, for other religious purposes. Every thing pertaining to this principal room calculated to make the place attractive and give effect to its services should be made a part of the plan. It should be lighted, heated, ventilated, and seated in the best manner possible.

The Sunday-school is an institution not to be neglected. It is an important and powerful auxiliary to the Church of God—it is its *nursery;* and suitable provision must be made for carrying on its work. Its exercises may be conducted in the main audience-room, when that is necessary; but it is far preferable to have a separate room for this purpose. The advantage of a separate room is two-fold: first, that the auditorium, being

* L. B. Valk, New York; W. M. Boyington, Chicago; R. G. Hatfield, New York; and others.

used only for public worship by the great congregation, may present an air of neatness, order, and solemnity, which will the more deeply impress all who come within its hallowed precincts; and second, that the Sunday-school room may be better adapted and more appropriately fitted up for its use, and yet be used for regular worship when the congregation is small. It must be made pleasant and attractive, to secure the best attendance of old and young. A few good maps, and large, choice, nicely-framed pictures and mottoes hung on the walls, will not only beautify the room, but make good and lasting impressions on the minds of both teachers and pupils.

The most economical and convenient way of providing a separate Sunday-school room is in the basement plan,* with a ceiling from ten to twelve feet high, and all above the ground, if possible, so that it may be light, airy, and healthy. This arrangement will be inconvenient to aged and infirm persons, on account of the difficulty they meet in reaching the audience-room by a long stairway. The committee must weigh both sides of the question. If the ground-floor is preferred for the auditorium, the Sunday-school apartment may be in the rear of it,† either on the first or second floor. This arrangement is more expensive than the other, but may often prove more satisfactory.

A third and smaller room will be of great advantage. It can be used for the separate recitations of infant or Bible-classes, or for general class, prayer, and other meetings.

In stations, the pastor cannot well do without a study or office; and if one cannot be provided in the main building sufficiently large and comfortable, it can be built separately on the church-lot, or near at hand. The best manner of heating is the open grate or fireplace. Apartments for fuel, and also for retirement, ought not to be omitted from the plan. All these may be advantageously combined in one building, as in Design No. 10, in which all are properly arranged inside of the main walls.

Still another suggestion. It is desirable that every church have a vestibule, though small; for it will conduce largely to the convenience, quiet, and comfort of the congregation. Fig. 2 represents a very desirable arrangement in this respect for a cheap church.

Finally, a spire, tower, or cupola will distinguish the building from others of common use, as well as serve other important ends; and must be taken account of as a part of every design for a church in city, town, or village. And this part of the plan should be executed at the proper time along with the rest of the building, and not left, as it frequently is, to be finished at some indefinite future time—that is, never. Better leave some other part behind, if the house cannot be finished up at once, whose demands for completion will be more urgent than the unfinished top of a spire to those already occupying the house. It is not proper to build a church *to* a tremendous tower or spire; but that a church should have a duly-proportioned spire, is not only admissible, but very desirable.

It was once asked why the tower of a certain church stood unfinished. The question was answered by a wag: "It was found that the congregation owned no higher up."

* As in Des. Nos. 9 and 10. † As in Des. No. 4.

Villages and cities cannot recommend themselves more highly to visitors and passing travelers than by the neat spires to their churches. The spire is not without its good effect upon those who, turning from the noise and confusion of busy life, or from the sweet quietude of home, responsive to its inviting look and led by its attractive form, come to pay the heart's sincere devotion to a gracious God within the precincts of his holy temple. "Of all Christian symbols the spire is, perhaps, the most striking and full of meaning. While the massy walls and square, solid tower underneath seem expressive of the enduring nature of Christ's Church, lightly mounting from the summit, amid clustering pinnacles, the stately spire crowns the whole noble work, and speaks the upward yearnings of the spirit for its heavenly home."*

STYLE OF ARCHITECTURE.—There is something more in the design and construction of a house than the mere muscular force employed in putting together dead material into the form of a shelter for man. Yet we sometimes see buildings which bear but little or no impress of thought, judgment, imagination, or any phase of liberal, aspiring life. The practical is not averse to the æsthetical; it is not itself without it. The evidence of intelligent design and the presence of the beautiful greatly and beneficially affect the spirit and life of man. They tend to enlarge and liberalize his views, refine his taste, and quicken his emotional nature, and elevate intellectually and morally all who do not, through ignorance or prejudice, resist their influence. There is much, therefore, in the *architecture* of a church; for it more or less affects every worshiper, and even impresses itself upon the forming character of the children and youth who are taught the sublime principles of the gospel from its pulpit. Besides, it stands out, ordinarily, as a correct exponent of the culture, sentiment, feeling, and liberality of the people in whose midst it appears.

As persons differ in their views of the various styles of architecture, it may not be amiss to dwell upon this subject more at length than would otherwise be done.

At the outset, however, let it be understood that our houses of worship are not to be less respectable and attractive than the houses of those who worship in them. "We cannot understand the feeling which would arch our own gates and pave our own thresholds, and leave the church with its narrow door and foot-worn sill; the feeling which enriches our own chambers with all manner of costliness, and endures the bare wall and mean compass of the temple."† The church should be in all respects the *best* its supporters can make it. And it is to be remembered that harmony, good taste, perfect design, and appropriate style can be maintained in the erection of the simplest chapel as well as the grandest church. Each may be made "a thing of beauty," even without costly materials and expensive details. There is no reason why any church should be so deficient, deformed, inelegant, or ugly, as that, in a few years, our successors will be compelled to pull it down and build another in its place.

The object at present is to consider some of the leading styles of architecture, so as to make a selection from them. The task of selecting must be undertaken without prejudice against any particular style on account of its history or past associations. Here

*H. H. Holley. †Ruskin.

is the chief difficulty. One objects to the Gothic style, because, in his mind, it is associated with Roman Catholicism. He sees no beauty, or grace, or elegance, or worthy expression, in the perpendicular lines, the pointed arch, the ribbed or groined ceiling, the tower surmounted by the lofty spire, and other characteristics of the style, and therefore prefers the Norman architecture. Another, remembering the barbarous character and bloody wars of prominent nations among whom the Norman style flourished, associating it with their fortified towers and feudal castles, rejects this style, favoring the Grecian, or classical, under the idea that it is unobjectionable. But, still another person concerned in the choice cannot forget those Grecian temples, dedicated to imaginary gods and used in unholy worship. The name of *Grecian* or *classic* sounds well; but he is reminded that the Doric pillars bespoke the worship of Jupiter and Mars; the Ionic that of Bacchus, Apollo, and Diana; the Corinthian that of Vesta, etc. Besides, says he, St. Paul's, of London, the representative church of the Establishment of England, and above all St. Peter's, of Rome, are both Grecian architecture. He determines in favor of the Gothic, or some other style. So the question may sometimes be difficult to settle. Indeed, it cannot be settled on this basis; for the architecture of no age nor country is free from objections of this sort. On the same principle we may object to a good system of ventilation, or refuse to observe the laws of acoustics, because they receive special attention in the construction of public halls and theaters.

The intention of the author and limits of this work will not allow more than a very general classification of architecture. No other divisions are set forth than those just mentioned, although pages might be taken up in enumerating and defining others.

Some writers* assert, indeed, that "after all, there are, comprehensively speaking, but the Grecian and Gothic styles. These are modified into peculiar forms, some of which have attained the rank of distinct orders, and yet are, to some degree, in subjection to the rules of the two principal divisions named. These two principal orders are almost entirely opposite to each other, differing in all other essential parts, and producing entirely contrary effects on the mind." Dr. Daggett draws the following contrast between a Greek and Gothic edifice, which well serves to bring out the distinctive features and effects of these two styles: "An observer finds the difference pervading every part, extending to the minutest device or ornament, and carried out into the general effect; each building rising as it were from one conception of the mind, according to its own laws enlarging itself, and, by coherence and unity, coming to that harmonious result which is called, according to the position from which it is described, either the expression or impression of the whole: as two kinds of trees grow, by their respective laws, each into its proper beauty. For example, in Gothic architecture the lines are perpendicular or less slanting, the curves intersect one another as if all aspiring to greater height, and, by mechanical contrivance, one part surmounts another, to a great comparative elevation; and, besides giving the pleasure of ingeniously overcoming difficulty in the construction, the whole has an air of loftiness, grandeur, and natural solemnity, and sometimes grace combined with vastness. In the Greek architecture, on the other hand, the lines are for the most

*Rev. G. Bowler.

part horizontal, and the proportions of all the parts are nicely adjusted, both for strength and effect on the eye; the whole making the impression of solidity or massiveness, repose, and serenity; the Doric order having also the charm of the utmost simplicity, and the Corinthian of rich yet chastened decoration." By farther division and subdivision of these styles, various other styles have been developed, answering to the peculiar taste and genius of artist or people, each style having some special feature and effect setting it apart from all others.

These general principles, with their adaptation to locality and people, should have more to do with selecting a style for a church than any present or past association that architecture may have with error and superstition. We are too apt to make our own the expression of Coleridge that "a Gothic cathedral is a petrified religion;" and we do this because we do not understand him or the subject of which he speaks. Is it the "*Gothic*" architecture, or the "*cathedral*," or the "*religion*" itself, in which petrifaction inheres? However the Romish religion may be "petrified," and to whatever extent the "cathedral" may be involved in that petrifaction as its cause, there is nothing in the "Gothic" style itself that is stiff, cold, formal, or repulsive; but rather, there may be manifested in it more life, beauty, skill, and design than in any other. It has not been observed that a "cathedral" or church whose architecture is Norman, Byzantine, Romanesque, or classic, has any less petrifying influence on the religion of its worshipers than the Gothic. One may be made as dark, damp, and chilly as another. None are more expressive of cheerfulness, or more in accord with the joyousness of the religion of the Bible, than a church in the Gothic style of architecture.

Nor is there as much ground for prejudice against the Gothic, on account of the alleged ignorance and barbarity of the Goths, with whom it is associated, as some suppose. "The Goths, originally savage and barbarous, became a cultivated and enlightened people. Grotius gives them high commendation for morality and integrity, love of justice, and good faith."* Some of their kings have been classed with Charlemagne, Alfred, and others, as liberal patrons of literature, science, and art. By Latin and other writers favorable mention has been made of their poetic and historic writings, their music, and monuments of artistic skill. In speaking of the reproach usually thrown out against the Teutonic nations for introducing ignorance and barbarity into the Roman provinces, Schlegel† says that it is, in extent at least, "altogether false and ungrounded." To none of all these nations is this reproach applied with so much injustice as to the Goths who lived at the time of the first Northern inroads. For many centuries before these expeditions commenced the Goths had been already Christians; they were well acquainted with the importance of regular laws, and with the relations of the learned and religious orders of society; and the truth is that, far from promoting any work of destruction in the Roman provinces, they were indefatigable, as far as their powers and circumstances admitted of it, in forwarding and maintaining the interests of science. The only exception to this is to be found in those times when the Gothic tribes entered Italy under

*"Am. Cyclopedia." †"History of Literature." The New Testament having been translated into their language as early as A.D. 360.

the guidance of a foreign, a savage, and a heathen conqueror; or when, in some particular instances, they were exasperated, by party hatred and Arian bigotry, to take too severe revenge against the equal hatred and bigotry of their *Catholic opponents*. In the time of Theodorick (king), and under the government of the Goths, Italy was just beginning to enjoy the opening of a new period of happiness. The true misery and the true barbarism began when the Goths were expelled, and Italy submitted her neck once more to the deadening tyranny of Byzantine eunuchs and satraps. Theodorick, on ascending the Italian throne, made the promise that he would endeavor so to rule that "the only regret of the people should be that the Goths had not come at an earlier period." This promise was maintained by himself and others who succeeded him, some of whom have been justly celebrated by other nations in heroic poems and historic songs.

But again, what was the origin of the Gothic style? "That it was not invented by the Goths is now admitted on all hands, for the nation of the Goths had passed away long before any existing specimens of it were formed. With regard to the specimens of Gothic architecture which are to be found in the East, these are all, beyond any doubt, of European origin, and exist only in cities and churches which formerly belonged to the Knights of the Temple and of St. John. The most flourishing period of this architecture was in the twelfth, thirteenth, and fourteenth centuries. Its chief seat was originally in Germany; and German artists constructed, to the admiration of all Italy, the great cathedral of Milan. But it was by no means confined to Germany and the German Netherlands; it flourished, on the contrary, with equal success in England and in the northern parts of France. Who was the first inventor of it is entirely unknown."* "The term Gothic appears to have been first brought into use by the Italians, who applied it to all such buildings as were not classic in their character."† "The employment of the term and its application seem to have arisen from the idea entertained by the Italians that the style of building to which they applied it was introduced by the Goths after their incursions into Italy."‡ But it is very plausibly asserted that "the Goths did not invent this, or indeed any, style. They had no architecture of their own, and are not only innocent of introducing any new style into Italy, but, more than that, they do not seem to have caused any alteration in the old. What changes did take place arose very naturally from the gradual decay of the previous styles, and the growth of feelings and sentiments wholly at variance with the paganism to which the greatest buildings in the classical styles had been dedicated."§

In England, the Norman style, which is distinguished principally by its arches being semicircular, had its origin about the time of the Conquest, and continued to the close of the reign of Henry II. (1189). From this time on to the beginning of the reign of Edward II. (1307), architecture was in a mixed and transition state, but developed at that time into what was called the "Decorated English" style. In reference to this transition Mr. Davidson remarks that, "after the Conquest, the rich Norman barons erecting magnificent castles and churches, the execution manifestly improved; but the introduction of shafts instead of massive piers first began to approach that lighter mode of building

* Schlegel's "Lectures." † E. A. Davidson. ‡ Nicholson. § "Manual of Gothic Stone-work."

which, by the addition of the pointed arch, and by an increased boldness of conception and delicacy of execution, ripened, at the close of the twelfth century, into the simple yet beautiful Early English style. At the close of another century, this style, from the alteration of its windows by throwing them into large ones divided by mullions, introducing tracery in the heads of windows, and the general use of flowered ornaments, together with an important alteration in the piers, became the Decorated English, which may be considered the perfection of English Gothic."

From these facts of history, gathered from the best authorities, we may be led to doubt that the Goths originated what is known as the Gothic style of architecture. But if they did, there is no ground for prejudice against it on account of its origin, development, or history. Indeed, it is probably true, as said by Mr. John Ruskin, the accomplished artist and Christian philosopher, that, whatever the date of the original use of the term Gothic as applied to architecture, "it was intended to imply reproach." "But," says he, "there is no reproach in the word, rightly understood." The term doubtless had its origin in the prejudice of Italian or Roman artists, whose professional character and personal interests were likely to be affected by the introduction and popularization of an architecture embodying scientific elements with which they were unacquainted, and in whose construction they were totally unskilled.

These remarks have been made in reference to this particular class of architecture in order to set it upon an equal footing with all others, that it may be judged, admired, and adopted on the ground of its own intrinsic merits. It has fully as much strength, durability, and beauty as any other style, and may be constructed as cheaply. In masonry the curved line for the head of openings has an advantage in strength over the straight or square. Building committees, therefore, have nothing to lose in its adoption and use, nor will any of the institutions or interests of religion suffer thereby. These committees should consider the subject with reference to its real merits, and, without prejudice, conform the architectural style of their churches, or other buildings, to either of the three general divisions mentioned. A prominent and distinguishing feature of these styles is the shape of their openings (with an adapted construction throughout), and it matters not, for practical purposes, whether these styles be designated as *Grecian, Norman, and Gothic*, or *square, round, and pointed.* Neither style is very often produced *pure*, but only with reference to a few leading characteristics.

It would be out of place here to express judgment as to which style is best suited to any particular community, or which should be adopted exclusively for our churches. This is a matter which each committee may prefer to determine for themselves; and their *taste*, more than any thing else, is *directly* involved in the selection.

The Cost of Building.—No one of safe business capacity will overlook this matter in the selection of a plan. He who does not, in advance of commencing to build, "count the cost," and restrict the intended expenditure to the amount of his resources, will most likely meet with disappointment and failure. Having ascertained, on a secure basis, what funds can be raised for the enterprise, he can determine what character of house can be erected for that sum. This involves calculations that must be made with care and correctness. The rules here given apply to building in general. Each general

division of the subject will, as far as possible, be noticed under a separate heading, together with suggestions appropriate to each; and the committee will have to pass through them all to obtain the information they desire—or at least through that part of each which relates to an estimate of the cost.

As the duties of trustees associate them with the building operations in charge of the committee, a chapter in reference to their office and duties here follows.

TRUSTEES.

A TRUSTEE is one to whom property is committed in trust. From five to nine trustees are usually selected by the Church "for holding Church-property." They are required to be members of the Church, and twenty-one years of age. To act properly and legally, they must organize themselves into a board, with chairman, secretary, and treasurer, and transact their business together as a body, and in a business manner. They are subject to the specific law of the Church in their case, the law of the State, and the instructions of that official body of the Church by which they are elected and held amenable; and which body, except where the trustee may be held "in joint security for money," "shall have power to dismiss any of them from office."*

It is the duty of trustees to receive all titles to Church-property obtained, and to make titles where the property is sold. No improvement should be made or building commenced on any lot or parcel of land until secured by deed properly signed, acknowledged, and recorded. Non-observance of this rule has often caused difficulty and loss to the Church. A special form of deed is prescribed for receiving property, and no deviation ought to be made from that form. There is no authority for accepting property on other conditions. Any restrictions are likely to work evil, sooner or later, and have been wisely interdicted. Only in case of gifts are these restrictions introduced; but he who gives to the Church ought not to insist on conditions that cannot be met at once by the other party to the transaction, and prevent the property being secured "firmly by deed, and permanently *in fee simple*," TO THE CHURCH.

The care of property—its protection from damage—devolves upon trustees. They are also expected to guard the houses of worship against improper use; for the house of God is, or ought to be, solemnly "set apart from all unhallowed or common uses."† If the formal dedication of the church has been neglected, the rule still applies; for the spirit of the law, at least, is violated, and the objects for which the house was erected are contravened, by such "unhallowed or common uses." A faithful application of this rule will prevent the desecration of our houses of worship.

It is not out of place to suggest here that, in many of our rising towns and cities, as

* "Discipline, M. E. Church, South." † Form of Dedication.

well as growing country places, a little timely attention given by ministers, trustees, and others interested in the Church, might secure eligible, ample, and beautiful sites for church and parsonage, while building lots are comparatively cheap—to be had at merely a nominal cost, or, as is frequently the case, "without money and without price." Some denominations are quite attentive to such matters, and others ought to be provoked to like good works by the evident wisdom of the policy.

BRICK-WORK.

Bricks of a good quality are equal in most respects to any other material used for building purposes. They make a wall solid, strong, durable, and may be worked into the most elaborate moldings and ornamentation. They are usually divided into three classes or varieties. The "*arch brick*," or "*eye brick*," which are always vitrified in part, having been exposed to the greatest heat of the fire in burning, are very hard, but brittle, and do not work or last well. The "*red and hard brick*" are those taken from the interior of the kiln, and are of the best quality. *Salmon brick* are those not well burned, and therefore have not strength and durability for heavy work. They must not be exposed to the weather, or to any great pressure. Hard and salmon brick mixed are called *merchantable* brick. It has been ascertained by experiment that good brick (of the second class), having the specific gravity of 2.168, requires 1,200 lbs. on a square inch to crush it;* with specific gravity 1.841, 562 lbs.† A cubic foot of brick-work weighs about 120 lbs., and absorbs one-fifteenth of its weight of water.

The *bond* of brick-work is the connection of the bricks with each other, by which the strength of a wall is secured. *Headers* are bricks laid across the wall with heads exposed. *Stretchers* are laid lengthwise of the wall. Headers generally constitute every fifth or seventh course, and where the wall is more than 9 in. thick the headers lap on each other. In dry weather the strength of a wall will be increased by wetting the bricks before they are laid. The durability of brick is much impaired by the kiln being cooled too suddenly.

Measuring and estimating the value of brick-work is usually done by the thousand bricks laid. Every square foot on the face of a wall the width of a brick (4½ in.) in thickness contains seven bricks. Therefore, to find the number of bricks in a given wall, *multiply the superficial feet of the wall by* 7, *and then by the number of widths* (4½ *in.*) *in the thickness of the wall.* Another rule is to *find the superficial feet in the wall by multiplying its length by its height, and then multiply the number of feet by the following figures: For* 4½ *in.* (*half-brick*) *wall, by* 7; *for* 9 *in.* (*one brick*) *wall, by* 14; *for* 13 *in.* (*one and one-half bricks*) *wall, by* 21; *for* 18 *in.* (*two bricks*) *wall, by* 28. Continue the same proportion as the thickness of the wall increases, adding 7 to the multiplier for each 4½ in., or half-brick.

* Johnson's "Practical Measurer." † Vodges' "Art. Comp."

To measure brick *cornices, take the height and length, and that portion which does not exceed 4½ in. projection from face of wall, allow half-brick thick; over 4½ in. projection and not exceeding 9 in., allow one brick thick.**

The number of feet in gable walls is ascertained as follows: *Multiply the length of the wall where the gable begins by half the height of the wall, above that line.*

Paving is measured by the superficial yard, or 9 square feet, which will require 41 bricks when laid flat, and about twice that number when laid on edge.

But the above estimate includes the mortar and openings in the wall; so that, in order to get the *actual* number of bricks in the wall—that is, what number will be required to build that much wall—it is customary to count one-fourth off for mortar and openings. This done, the estimate can be made for mortar and work separately. One barrel of lime and three barrels of coarse (to five barrels fine) sand will make mortar enough to lay 1,200 bricks. The price per day or per thousand for laying brick will vary in different localities. When laid by the thousand, wall measurement is used, and not the *actual* number of bricks laid. Some workmen deduct the doors and windows, while others estimate them as solid wall.

Mortar is made of one part unslaked lime to three parts coarse sand, and should be mixed several days before using, that the lime may be well slaked, and then "tempered" to suit when used.

All space between the bricks must be well filled in with mortar, to make a solid wall.

Example.—To find the number of bricks in a wall, the main part of which is 40 ft. long, 20 ft. high, and 18 in. thick, the gable being 10 ft. high and 13 in. thick: 40 multiplied by 20=800 superficial feet in main wall, which multiplied by 28 (the number of bricks to the foot in an 18 in. wall)=22,400 bricks. The lower line of the gable, 40 ft., multiplied by half the height, 5 ft.=200 ft., which multiplied by 21 (the number of bricks to the foot in a 13 in. wall)=4,200 bricks. Adding the two together gives the number of bricks in the entire wall, 26,600.

If the wall has the usual number of openings, the *actual* number of bricks may be found by deducting one-fourth from the wall measurement. One-fourth of 26,600 is 6,650, which subtracted leaves 19,950 actual bricks. As every 1,200 bricks require one barrel of lime and three barrels of sand, 19,950 divided by 1,200 gives the amount of lime necessary for the work, about 17 barrels; and this multiplied by 3 gives the amount of sand, 51 barrels. The prices being known, the cost of the work can be easily estimated.

WOOD-WORK.

Wood is more used for building purposes than any other material, especially in villages and country places. It enters largely into the construction of stone and brick

* Johnson's "Practical Measurer."

buildings, as well as composing almost entire structures itself. Buildings of wood may be highly ornamented, and also made very durable. Their durability depends largely on the selection of good material, and its being properly and substantially put together. They have been known to last one hundred and fifty years. Wood is extensively used in building because it is generally plenty, cheap, and easily worked.

The work of framing, sheathing, shingling, putting on weather-boarding and flooring, is estimated by the square of 100 feet, according to the following rule: *Multiply the length by the height, and divide by* 100, which gives the number of squares. Gables may be estimated according to the rule given to find the superficial feet in the gable of a brick wall.

Lumber is estimated by the 100 or 1,000 feet, according to the following rule: *Multiply together the thickness and width in inches, the length in feet, and the number of pieces; and divide the product by* 12. Or the calculation may be shortened by cancelation, thus: *Place on the right of a perpendicular line the thickness and width in inches, the length in feet, and the number of pieces; and on the left of the line* 12. Cancel as the figures will allow, and multiply together those *that remain.* The cost of the lumber may be included in the same calculation by *placing the price per hundred feet, in cents, on the right of the line, and* 100 *on the left. The answer will be in cents.*

Example.—What will be the cost of four pieces of lumber 2 in. thick, 6 in. wide, and 10 ft. long, at $1 50 per hundred feet? To any one understanding the rules of cancelation this is a short and easy process.

	4
12	2
	6
	10
100	150

60 cts.

Plank less than 1 in. thick is counted as 1 in. thick.

The length of rafters is according to the "pitch," or height, of the roof. "Quarter-pitch" is where the height of the gable is one-fourth of the width of the house; "third-pitch" is one-third of the width; "half-pitch," which makes a stronger and more durable roof than either of the others, is one-half of the width. Having determined the pitch of the roof, the length of the rafter is ascertained upon the principle of finding the hypothenuse of a right-angled triangle, when the base and perpendicular are known, the half-width of the house being the base: *Add together the squares of the perpendicular and base, and the square root of the sum will be the length of the rafter.* If a square or ruler be at hand, a drawing can be made of the triangle, counting an inch for a foot, and the hypothenuse or rafter measured, in as little time as would be required to make the calculation with figures. In many cases this would be the preferable way.

It is sometimes desirable to *ascertain the height of objects*, which it is not convenient to do by actual measurement—as the top of a house, or spire of a church. This may be done by making a right-angled triangle of any size, with base and perpendicular equal (each 3 ft., for instance); place the triangle so that the base will be on a line with the base of the object, and the hypothenuse on a line with the highest point of the object. The distance from the intersection of the hypothenuse and base of the triangle to the base of the object will be the height of the object from the ground. Or the same measurement may be taken by a still simpler process; it will be less trouble to those who prefer it, and sufficiently accurate: Let a man take a pole exactly his own length, lie on

his back (on a level with the base of the object whose height is to be measured), with the pole held in a perpendicular position between his feet, where he can see the top of the object in line with the top of the pole. The distance from the top of the man's head in this position to the base of the object will be its height.

Weather-boarding is estimated by multiplying together the length and height of the wall to be covered, and adding one-fourth more for waste and lap.

Shingles are counted by the thousand. The length exposed to the weather depends on the length of the shingle. There should be three thicknesses all over the roof. Therefore, a shingle full 18 in. long can expose 6 in.; one 16 in. long may expose 5 in.; but 14 in. shingles cannot expose more than 4½ in. A shingle is usually considered 4 in. wide. Shingles exposing 4½ in. to the weather require 1,000 to the square (allowing for waste); with 5 in. to the weather, they require 900; 6 in. to the weather, 750 shingles. *The number of squares in the roof multiplied by the number of shingles to the square will give the number of shingles required.*

Doors and window-frames are generally estimated by the piece or opening. *Box window-frames* should always be used, and the sash hung with pulleys and weights, whether the house be of wood, brick, or stone. Ordinarily the jam of the box is 1½ in. thick (with width according to thickness of wall), and the space for the weights at least 2 in. In frame houses the stud closes up the back of the box, but in brick houses the back is closed with 1 in. plank. Taking the width of the box from the opening between the studs gives *the size of the sash*, from which the *size of the glass* to be used is obtained.

The following tables will be serviceable in estimating the cost of this kind of work, and in making out orders for what is wanted. The prices will vary some in different localities.

TABLE FOR TWELVE-LIGHT WINDOWS.

WINDOW FRAMES.						SASH (LIP).				HANGINGS.		BLINDS.
Width.	Height.	BRICK WALL.		FRAME WALL.		Thickness.	Size of Glass.*	PRICE PER WINDOW.		Each Weight†	Each Cord.	Slats, Rolling or Stationary.
		Box.	Plain.	Box.	Plain.			Glazed.	Unglazed.			
ft. in.	ft. in.					in.	in. in.			lbs.	ft.	
2 4	3 10	$3 50	$2 25	$3 00	$2 25	1¼	8 by 10	$1 75	$0 60	4	2½	$2 00
2 10½	4 6½	3 75	2 50	3 25	2 50	1⅜	10 by 12	2 50	1 00	5	3	2 25
2 10½	5 2½	4 00	3 00	3 50	2 75	1⅜	10 by 14	3 00	1 25	6	3½	2 50
2 10½	5 10½	4 50	3 25	4 00	3 00	1⅜	10 by 16	3 50	1 25	7	4	2 75
2 10½	6 6½	5 00	3 50	4 50	3 25	1⅜	10 by 18	4 00	1 50	8	4½	3 00
2 10½	7 2½	5 50	3 75	4 75	3 50	1⅜	10 by 20	4 50	1 75	9	4¾	3 25
2 10½	7 10½	6 00	4 00	5 00	4 00	1⅜	10 by 22	4 75	2 00	10	5	3 50
2 10½	8 6½	6 50	4 75	6 00	5 00	1⅜	10 by 24	5 00	2 25	11	5¼	4 00
3 4½	5 10½	5 00	3 50	4 50	3 50	1⅜	12 by 16	4 50	1 50	9	4	3 50
3 4½	6 6½	5 50	3 75	5 00	3 75	1⅜	12 by 18	5 00	1 75	10	4½	4 00
3 4½	7 2½	6 00	4 00	5 50	4 00	1½	12 by 20	5 50	2 00	11	5	4 50
3 4½	7 10½	6 50	4 25	6 50	4 25	1½	12 by 22	6 00	2 25	12	5¼	5 00
3 4½	8 6½	7 00	4 50	7 00	4 50	1½	12 by 24	6 50	2 50	13	5½	5 50

* The sizes of glass given apply to both frames and sash. † Two weights to each sash, four to each window.

TABLE FOR DOOR-FRAMES AND DOORS.

DOOR-FRAMES.			DOORS.				
Sizes.	Frame Wall.	9 in. Brick Wall.	13 in. Br'k Wall.	INSIDE DOORS.		FRONT DOORS—RAISED MOLDINGS.		
				Thick.	Rais'd Panels	Sizes.	Thick.	Fine Fin.
ft. in. ft. in.				in.		ft. in. ft. in.	in.	
2 6 by 6 6	$2 25	$2 75	$3 25	1⅛	$2 25	3 0 by 7 0	1⅜	$7 00
2 8 by 6 8	2 50	3 00	3 50	1¼	2 50	3 0 by 7 6	1⅜	7 50
2 10 by 6 10	2 75	3 25	3 75	1⅜	2 75	3 0 by 8 0	1⅜	8 00
3 0 by 7 0	3 00	3 50	4 00	1½	3 00	3 0 by 9 0	1⅜	9 00
3 0 by 7 6	3 25	3 75	4 25	1⅝	3 50	3 0 by 7 6	1¾	9 00
3 0 by 8 0	3 75	4 25	4 75	1¾	3 75	3 0 by 8 0	1¾	10 00
3 0 by 9 0	4 50	5 00	5 50	1⅞	4 00	3 0 by 9 0	1¾	11 00

The above tables give regular sizes, and for square openings. Irregular sizes are extra price. For segment, half-circle, or Gothic heads, add from 50 cents to $2 per window.

In ordering frames for doors or windows, the thickness of the wall should be given, stating whether for frame or brick house, and whether for outside or inside. Give description of casing, if to be cased. *For doors* and *blinds*, give width, height, thickness, and finish. *For sash*, when the frames are already made, give width and height of frame in clear, thickness of sash, number and size of lights. Bills for lumber or mill-work should be made out definitely and very carefully, and a copy of the bill retained.

The lives of many people frequently depend on the strength of materials used in the construction of public buildings. Not only is it necessary that the materials be of good quality and well put together, but *it must be of proper dimensions and proportions.* The position in which a piece of timber is placed has much to do in determining the weight it will safely bear. The parts of a building specially concerned in these calculations are bearing-beams, joists, and columns.

The principles and rules governing in these matters have been ascertained by actual experiments.* And while these experiments have not been uniform in their results, it will be safe to adopt an average of their estimates, especially as it is the rule of architects and mechanics in practice *not to subject any material to a strain or pressure greater than one-fourth its actual power of resistance.* The figures here given indicate the breaking weight.

STRENGTH OF MATERIALS WHEN PULLED IN THE DIRECTION OF THEIR LENGTH; THE SIZE OF THE PIECE BEING 1 SQUARE INCH.

Iron, Cast	requires	20,000 lbs.	Elm	requires	13,400 lbs.
Iron, Wrought	"	60,000 "	Locust	"	20,500 "
Steel	"	120,000 "	Oak, White	"	10,500 "
Tin, Cast Block	"	5,000 "	Pine, Yellow	"	12,000 "
Lead, Cast	"	500 "	Poplar	"	7,000 "

* Rennie, Du Hamel, Emerson, Rondelet, Hodgkinson, Tredgold, Vodges, etc.

STRENGTH OF MATERIALS, ETC. (*Continued.*)

Ash (wood) . .	requires	14,000 lbs.	Walnut . .	requires	12,800 lbs.
Cedar . . .	"	11,400 "	Brick . . .	"	290 "
Chestnut, Sweet .	"	10,500 "	Mortar, 20 years .	"	52 "
Cypress . . .	"	6,000 "			

Rule: *Multiply the width by the thickness in inches, and the product by the number of pounds that will break the material; the answer will be the number of pounds required to break the piece.* Example: What weight, pulling lengthwise, will be required to break a piece of pine 2 in. by 4 in.? The width and thickness multiplied together=8, the product multiplied by 12,000 the weight to 1 square inch=96,000 lbs.

TABLE OF CROSS-STRAINS OF WOOD, EACH PIECE BEING 1 FT. LONG AND 1 IN. SQUARE, WEIGHT APPLIED IN THE MIDDLE.

Cast Iron . . .	broken by	850 lbs.	Walnut, Green . .	broken by	487 lbs.
Oak . . .	"	660 "	Pine . . .	"	658 "
Ash	"	635 "	Poplar . . .	"	327 "
Elm . . .	"	540 "	Chestnut . .	"	450 "

The strength of a beam is as the thickness and square of the width directly, and inversely as the length. The strength depends chiefly on the width of the piece—that is, on that dimension which is in the direction of the strain. If a beam 2 in. wide and 1 in. thick support a given weight, another beam of the same width and double the thickness will support *double the weight.* But if a beam 2 in. wide and 1 in. thick support a given weight, another 4 in. wide and 1 in. thick will support *four times the weight.* Hence, *beams of equal thickness are to each other as the square of their widths.* Again, if a beam of a given cross-section, and 1 ft. long, support a known weight, another beam of the same cross-section, but 2 ft. long, will support only half the known weight. Hence, the following rule has been established to find the greatest weight a given beam will sustain: *Divide the breaking weight by the length in feet; subtract* 10 *from the quotient; multiply the remainder by the thickness, and that product by the square of the width, both expressed in inches. The result is the greatest weight the beam will bear.* Example: What weight will be sustained by a pine joist 2 in. thick, 12 in. wide, and 16 ft. long? Divide the breaking weight for pine, as shown in the table, 658, by 16, the length in feet=41 with a fraction over. 10 subtracted from 41=31. Multiply this remainder by 2, the thickness of the joist, making the product 62. Multiply this product by 144, the square of the width in inches, which gives 8,928 lbs.

The strength of girders, etc., may be ascertained in the same manner, remembering to take in each case only one-fourth the result in practice.

The proper width of a joist is ascertained when the thickness and length of bearing are given, *by dividing the square of the length in feet by the thickness in inches, and multiplying the cube root of the quotient by* 2.2 *for pine and* 2.3 *for oak.** For girders, *multiply by*

* J. Johnson, architect, St. Louis.

4.2 *for pine and* 4.34 *for oak*, instead of 2.2 and 2.3, as in case of joists. Example: The length or bearing of a joist is 10 ft., and thickness 2 in.; what should be its width? $10\times10=100$, $\div 2=50$. $\sqrt[3]{50}=3.684\times2.2=8$ in. with small fraction over.

Joists should not, if possible, exceed 18 ft. in length nor 16 in. from centers; and if supported by girders, not be longer than 14 ft. Every length of 10 ft. should be bridged, and a course of bridging added for every additional 5 ft. in length.

Cast-iron beams are often introduced in place of wood, as in brick-work where they are to be concealed.

TABLE SHOWING WEIGHT SUSTAINED BY CAST-IRON BEAMS, 1 IN. THICK.

Width.	Length.	Weight.	Width.	Length.	Weight.
1 in.	1 ft.	850 lbs.	5 in.	10 ft.	2,125 lbs.
1 in.	5 ft.	175 lbs.	10 in.	10 ft.	8,500 lbs.
1 in.	10 ft.	85 lbs.	12 in.	14 ft.	8,700 lbs.
5 in.	5 ft.	4,250 lbs.			

Iron beams are made into various shapes, to adapt them to their use and to resist weight from particular directions. Plain bars should not be subjected to more than one-fourth the above weights.

Columns are used to support heavy weights where the construction cannot be made self-supporting, as in the case of second floors, etc. In determining the dimensions of columns we consider not only their power to resist compression, or crushing force, but also the strength of their cross-section to prevent bending or bulging. The table for strength of cross-section has already been given.

TABLE SHOWING POWER PER CUBIC INCH OF MATERIAL TO RESIST COMPRESSION, OR CRUSHING FORCE.

Iron, Cast	90,000 lbs.	Pine	6,000 lbs.
Iron, Wrought	50,000 "	Red Brick	562 "
Elm	8,000 "	Soft Brick	220 "
Oak, White	7,500 "	Hard Limestone	17,000 "

Not more than one-fifth of these weights are to be considered in practice.

As cast-iron columns occupy less space than wood of the same strength, they are generally used when they can be obtained.

The weight resting upon a column is proportioned to the number of superficial feet in the floor supported by the column. The average weight* of men, women, and children is 106 lbs. The greatest weight a concourse of people huddled together can produce upon a given area is the weight to be provided for. Standing together they will not produce more than 75 lbs. to the square foot. The weight of floor, framing, etc., will not ordi-

*Johnson, from Quetelet's "Treatise on Man."

narily exceed that amount. Hence, it is safe to consider 300 lbs.* to the superficial foot of flooring.

TABLE SHOWING THE STRENGTH OF CAST-IRON COLUMNS.

Diameter.	Length.	Sup. ft. Flooring.	Weight.
5 in. solid	10 ft.	150⅞	45,200 lbs.
5 in. solid	12 "	142½	42,700 "
6 in. solid	10 "	183½	55,000 "
6 in. solid	12 "	175	52,500 "
6 in. solid	14 "	165⅞	49,700 "
5 in. hollow 1 in. Metal	10 to 12 ft.	87	26,100 "
6 in. hollow 1 in. Metal	10 to 12 "	117	35,100 "
7 in. hollow 1 in. Metal	10 to 12 "	143	42,900 "

The wrought-iron used in building, such as rods, bolts, nuts, etc., may be estimated by the price of that kind of material and work in the locality where the building is to be erected.

The nails to be used in building constitute an item worthy of notice. The following table will enable any one to make an estimate of the quantity and suitable sizes of nails required for any particular work. Some manufacturers make them larger and others smaller than here mentioned. The table represents a nail of average dimensions and weight.

Other articles of hardware can be determined from any set of specifications suited to the proposed building, and the cost can be estimated by the prices in the market from which they are to be obtained.

TABLE SHOWING SIZES OF NAILS.

Sizes.	Length.	Nails per lb.	For what Used.
3-penny	1¼ in.	550	Lathing.
4-penny	1⅜ "	350	Shingling.
6-penny	2 "	200	Weather-boarding.
8-penny	2½ "	110	Weather-boarding and Flooring.
10-penny	3 "	70	Flooring.
16-penny	3½ "	54	Framing.
20-penny	4 "	34	Framing.
30-penny	4½ "	23	Framing.
40-penny	5 "	12	Framing.

* Vodges estimates "140 lb. per square foot of surface."

PLASTERING.

To secure a first-class job of plastering, the materials must be of good quality, properly proportioned and mixed, and applied carefully by one well practiced in the business.

Two-coat work consists of one brown coat and one white coat. Three-coat work has an additional brown coat before putting on the white. Sometimes the white is left off, and a "sand-finish" given in its place. The "sand-finish," or troweled brown coat, may be painted, calsomined, or whitewashed, and is best for blocking to represent stone. To receive paper, the plastering should have one strong brown coat with a thin white coat.

Lime for plastering should be slaked several days previous to being used, and mixed with sharp sand that is free from dirt and gravel. The brown coats consist of the proportion of one barrel of unslaked lime to three barrels of sharp sand. *The first coat* is stiffened with hair, to make a strong key between the laths and prevent falling off. The hair, which is usually kept in tight bales, must be well beaten with a stick and soaked in water before being worked into the mortar. About 5 lbs. of hair are required for every barrel of lime used. The weight of hair is 8 lbs. to the bushel.

The second coat is applied when the first is thoroughly dry. In putting on this coat, the walls are made even and smooth, ready for the skim or coat of white. It should be perfectly dry before the white is put on, but the surface should be dampened before the white is applied. *The last coat* consists mainly of lime, made into what is called "putty," then mixed with a small quantity of plaster Paris and clean sand. Care should be taken to prevent streaks and stains, so that the wall, when finished and dry, will be uniformly white.

Ornamental plastering, such as cornices, centers, etc., is made of plaster Paris, with a smaller proportion of "putty" (thoroughly dissolved lime), mixed at the time of using, as the mixture "sets," or becomes hard, in a very few minutes after being prepared.

Plain plastering is estimated by the square yard, and ranges in price from 30 to 50 cents. In some cases it is the custom to deduct the openings, but generally this is not done.

As the lime reduced into a paste only fills up the voids of the materials with which it is mixed, there is necessarily a very considerable diminution of bulk upon the quantities of the respective substances taken separately. The exact amount of this diminution varies, of course, with the lime or sand employed; but as a *general rule* it may be taken at about three-fourths of their collective volumes. It is thus represented in formula: If a=bulk of lime, b=bulk of sand, then $(a+b)\times 0.75$=bulk of mortar they will produce.* One cubic yard of mortar will require 1 cubic yard of sand (about 25 bushels) and 9 bushels of lime, nearly, $(25+9=34\times.75=25.5)$.

* G. R. Burnell.

It may be well to remember that mortar exposed to dampness requires a larger proportion of lime than in a dry position.

A putty for filling cracks and holes in plastering is made of whiting mixed with glue and water.

Laths are 4 ft. long, placed $\frac{3}{8}$ in. apart, average 17 to the square yard when put on, and require about 7 lbs. of nails to 1,000 laths. The distance between supports (joists or studs) should not be more than 16 in.; 2 ft. is sometimes allowed between studs, but this gives the laths such spring as to destroy the strength and durability of the plastering. Laths ought to be partly seasoned, to prevent cracking and staining the plastering.

One barrel lime, 3 barrels sand, 750 laths, $5\frac{1}{2}$ lbs. nails, and 5 lbs. hair, will put on about 50 square yards of plastering two coats thick.

STUCCOING.

It is sometimes desirable to stucco the outside walls of a house; but owing to the effect of weather upon it, there is usually much uncertainty about the durability of stucco-work. It may, however, be put on securely, and make a beautiful wall.

Take stone-lime fresh from the kiln and of the *best quality*, such as is known to make a strong and durable mortar. Slake it by sprinkling or pouring over it just water enough to leave it when slaked in the condition of a fine *dry powder*, and not a *paste*. Set up a $\frac{1}{4}$ in. wire screen at an inclined plane, and throw this powder against it. What passes through is fit for use. The rest must be rejected, as it would spoil the stucco.

Having obtained the sharpest sand to be had, and having washed it, so that not a particle of mud and dirt remain (for these destroy the tenacity of stucco), and having screened it to give some uniformity to the size, mix it with the lime in powder, in the proportion of *two parts sand to one part lime*. More lime would make a stronger stucco, but one by no means so hard—and hardness and tenacity are both needed.

The mortar must now be made by adding water, and working it thoroughly. On the *tempering* of the mortar greatly depends its tenacity.

The wall to be stuccoed should be first prepared by clearing off all loose dirt, mortar, etc., with a stiff broom. Then apply the mortar in two coats: the first a rough coat, to cover the inequalities of the wall; the second as a finishing coat. The latter, however, should be put on *before* the other is dry, and as soon, indeed, as the first coat is sufficiently firm to receive it: the whole should then be well floated, troweled, and marked off; and if it is to be colored in water-color, the wash should be applied so as to set with the stucco.* To be painted in oil, it must be dry.

* A. J. Downing.

PAINTING.

The painter is to give the "finishing touch" to the house. His strokes are to give it beauty and protect it from decay. Success in this art requires taste to select and associate colors, and skill to compound and apply them. Painting, however, has often to be done by those who have but little knowledge of pigments, and less skill of hand in wielding the brush. Many a time a piece of work—and especially an old house—suffers for lack of painting, and puts on the look of supreme ugliness, because the proprietor has not the means to employ an accomplished artist, or the knowledge himself to produce paint of a simple color, and then apply it. A coat of paint *almost* any color, and put on by a hand totally unskilled, is better than none at all. There are communities where the church-house has never been painted, or the paint has worn off by the lapse of years, but which could be improved one hundred per cent. by the use of a little paint. The outlay would be but a very few dollars, and the work could be done in a short time by almost any gentleman in the community. The changed appearance of the house would more than repay the expense and labor. The work should not go undone for the lack of a professional painter.

The limits of this work will not allow any details of color-making, or the chemical preparation of coloring substances, even were it desirable. It will be sufficient to suggest the method of preparing paints, and combining them to produce certain shades and tints, together with some practical rules in reference to the general subject of painting. These rules, and the recipes given, are such as have been recommended by the best authors.*

Oil Painting. *Rules, etc.*—Prepare the ground of the work by making it clean and dry.

See that the colors are equally well ground and duly mixed.

Do not mix much more, nor any less, paint than is necessary for the present work.

Keep the paint well mixed while the work is going on.

Have the paint of due thickness, and lay it on equally and evenly, taking as long a sweep with the brush as possible.

Do not apply a succeeding coat of paint before the previous one is dry and hard.

Do not add dryers to colors long before they are used, and do not use an excess of dryers at any time.

Do not overcharge the brush with paint, nor replenish it before it is sufficiently exhausted.

Begin with the highest part and proceed downward with the work.

Never apply paint to wood in a wet or green state; for the wood will decay or the paint scale off.

All dressed work, especially doors, frames, sash, etc., should have a coat of paint as soon as made.

* Downing, Jacques, Gardner, Field, etc.

Paint forms the best and most durable coat when put on in moderately cold weather, and when there is no dust flying. More dryer is required in cold weather than in warm.

Oil paint dries with a gloss, while turpentine makes a dead surface.

Do the work in the best manner, keeping it and the tools as clean as possible.

Wire-bound brushes are considered the best, with bristles long, soft, and elastic, and will be cheaper in the end than those of a lower price.

Brushes used by house-painters are either round or flat, the latter being used principally on large surfaces, as weather-boarding.

Paint-brushes, when not in use, should be cleaned and kept *suspended* in water; the binding being above water, and the lower part of the brush clearing the bottom of the vessel.

Killing knots is the first process in painting, and is necessary especially to a neat finish of inside work. The object is to prevent the knots showing through the paint.

One method consists in applying wet lime to the knots, which, when dry, should be rubbed with a hot iron, to melt out resin or turpentine that might flow and disturb the paint. They are then to be pumiced and made smooth.

Another method is to take 1 lb. of gum shellac and put it in an earthen vessel, cover it with alcohol (90 per cent. is best), and set it in a warm place; shake the mixture occasionally, and in a day or two it will be ready to be used in coating over the knots.

Priming is the application of the first coat of paint. For *outside work*, where the surface is exposed to dampness, heat, cold, etc., the pigment, or body of the paint, is mixed with linseed-oil, without turpentine; for the oil forms a resinous coating by absorbing oxygen in drying, whereas turpentine leaves the pigments easily rubbed off. For priming, the *raw* oil is preferable to the boiled, as it more readily penetrates the wood and secures it against moisture. Turpentine is frequently and freely used in painting because it costs about half as much as oil, and makes the paint work easily and dry readily; but this is at the expense of durability where the work is exposed to the weather. If desirable to hasten the drying, litharge, or patent dryer, may be added, just before using, in the proportion of half a pint to one gallon of oil.

The mixture for this coat should be thinner than for the succeeding coats, but thicker for two-coat work than for three-coat.

White-lead makes the best body for priming, as it forms a foundation superior to any thing else, and constitutes the *basis* for most of the tints and shades. The best quality is determined by being *ropy* when lifted from the keg with a knife; while that which is adulterated with whiting, etc., is generally short and crumbly. *Zinc-white* is sometimes used instead of white-lead, but is inferior in covering properties. It does well used after a coat of white-lead has been put on. It may also be used in water, and is quite durable.

The first coat of paint should be well worked in with the brush, especially where there are cracks and holes to be filled up afterward with putty. The priming makes the putty adhere better.

It is a good plan, in mixing paint for the first coat, to mix enough at once for the

other coats also, leaving it tolerably thick; then dilute, or thin, to suit each coat before using.

Inside work requires priming similar to *outside*, except that a small quantity of turpentine is allowed.

Puttying, or filling up holes and cracks with putty, is done after the priming. Putty may be had from the stores ready for use, or made of whiting or powdered chalk worked into a tenacious mass with boiled linseed-oil. When applied, the surface should be left perfectly smooth, so as not to show through the paint. When thoroughly dry, it is very hard.

The second coat of paint should not be applied till the priming is dry and hard. It is to be thicker than the first, to make a smooth, solid surface, and may contain more turpentine than the priming, for either inside or outside work.

The third coat—if necessary to apply more than two in order to cover the surface—requires the same preparation as the second, applied regularly to give the surface a uniform appearance.

A finishing coat of white, for inside work, may be made by mixing fresh white-lead with turpentine to the consistency of cream, and adding a half-pint of light-colored carriage-varnish to every gallon of paint. This finish will stand washing with soap-suds better than most other white paints.

A beautiful glossy finish is made by mixing zinc-white with white Damar-varnish to the proper consistency, applying it when the white-lead paint (second or third coat) is dry. It should be laid on in a heavy coat, and brushed well and quickly, that is may flow or settle and leave no brush-marks.

Colored paints of any shade may be made by mixing the colors in powder, well pulverized, with oil; or, the various colors may be had, ground in oil and put up in cans, requiring only to be thinned with oil and turpentine for use.

Beautiful tints may be formed with white-lead as the basis by adding to the white paint any color ground in oil (or in powder) that may be selected, until the desired tint is obtained.

To produce the best effect, two or three different tints or shades of color should be used. The effect depends on whether they are judiciously chosen and combined. Too great a contrast must be avoided. If the body of the house be very light—light fawn, for instance—the facings of doors and windows and the trimmings of roof, etc., may be either a shade darker, or white. If the main building be painted dark, the trimmings may be a lighter shade of the same color; and if the body is light, the trimmings may be darker. It is better that the differences consist in *shades* rather than *colors*.

If Venetian blinds are used, they may be painted a *dark green;* or else the solid parts of them a shade darker than the trimmings of the house, and the slats a shade darker still.

Brick houses, when new, need never be painted, if nice, clean brick of uniform color can be had. A neat line of white mortar with clear red brick produces a pleasant effect. As soon, however, as a brick building becomes dingy and weather-stained it should be painted. This will not only enhance the appearance of the building, but also preserve

the materials. The suggestions in reference to selecting colors for frame buildings apply also to brick, except that the latter may put on slightly darker hues. The trimmings should be of a darker shade than the body of the house.

Roofs of wood, tin, or iron are made much more durable by giving them a coat of paint. In the list of recipes will be found some adapted to this class of work.

Inside work may be painted in light colors, or stained, to excellent effect. Sometimes the same shades can be used as on the outside. The base-board should be darker than the other finish of the room. The moldings of doors, windows, etc., may be made a shade darker than the other parts of the work. There is no better paint for sash than the white coat. Great care should be taken, in painting interior wood-work, not to touch the plastering, for even white-lead and oil will show yellow on white plaster. If desired, the walls may be painted some soft, light tint; but the ceiling should be white, or nearly so.

Selecting colors requires thought and taste. Much depends on the place where they are to be used—its outline and surroundings. For the exterior painting of frame houses, white is much used; but it should be generally confined to small houses, or those partially obscured by trees. It is exceedingly unpleasant to see a large house, in an open space, painted a glaring white. A small house, however, whether church, school-house, or residence, where imbedded in a cluster of trees, will appropriately and with good effect wear a white coat; but otherwise some of the neutral tints should be chosen. Fawn, drab, gray, and brown would be very appropriate colors, as they harmonize with the hues of nature and soft shades of almost any scene. A light, pleasant, cheerful tone should generally be given; and while larger houses wear more of a sober hue than small ones, they should not be too dark.

Recipes for oil painting will be serviceable to those not accustomed to mixing paints, or where the ready-prepared colors cannot be obtained. The following are recommended by the best authorities, and include the colors in general use:

1. *A gray color* for outside work, similar to the tint of unpainted timber after a few years' exposure. Mix with oil, etc., as before directed:

Linseed-oil, 5 gallons; white-lead, 100 lbs.; raw umber, ½ lb.; Indian-red, ½ lb.; lamp-black, 3 oz.; with a small quantity of turpentine, or other dryer.

The shade of this color may be changed by the addition of two quarts fine sand thoroughly mixed, the tint of the paint being made like that of the sand.

2. *Roofing paint* may be made of the above recipe by leaving out one-third of the white-lead. This constitutes a beautiful, cool, unreflecting gray tint.

Other preparations for painting roofs are sold ready for use; some of them, perhaps, of but little value, and many of them too dark a color. A color moderately light is preferable, composed of pigments least affected by the sun, air, and water—such as zinc-white, yellow-ochre, Indian-red, stone-ochre, burnt sienna, raw and burnt umber, asphaltum, lamp-black, etc.

Some painters object to using white lead on tin, preferring mineral or metalic paints, which are said to be less liable to corrode.

3. *A stone-color*, with soft, pleasant tint, like that of coffee greatly diluted with milk, is made by mixing as follows:

Linseed-oil, 6 gallons; white-lead, 100 lbs.; yellow-ochre, 5 lbs.; burnt umber, ½ lb.; Indian-red, ¼ lb.; chrome-yellow, ½ lb.; with usual dryers.

The tint of this paint may be changed to suit the taste by adding more Indian-red or chrome-yellow.

4. *A light stone-color*, with a more delicate tint than No. 3, may be mixed thus:

Linseed-oil, 5 gallons; white-lead, 100 lbs.; yellow-ochre, 2 lbs.; Vandyke brown, ¼ lb.; Indian-red, ¼ lb.; chrome-yellow, No. 1, ½ lb.; 1 qt. turpentine.

A darker shade for trimmings may be made by adding more brown.

The following list of combinations is given as a basis for mixing various tints. The desired tint may be easily produced by preparing the basis of the mixture and then adding gradually the pigment which is to give the coloring.

Combinations to form Tints.

For straw-color, add chrome-yellow to white.
For silver-gray, add lamp-black and indigo to white.
For French-gray, add lamp-black and purple to white.
For lead-color, add lamp-black to white.
For wood-color, add raw umber to white.
For drab-color, add burnt umber to white.
For buff-color, add yellow-ochre to white.
For cream-color, add red and yellow to white.
For ashes of roses, add lead-color and lake to white.
For flesh-color, add yellow and carmine to white.
For brown, add red and black to white.
For orange, add chrome-yellow and vermilion to white.
For chocolate, add brown and yellow to white.

Care should be taken not to prepare too much of the white paint before applying the colors, lest after mixing there should be more paint than is needed; yet, enough of the mixture should be made at once to put one coat on the entire job of work.

5. *A cheap, light gray color*, with hard surface, more durable than common paint, and equally suited to wood, brick, or stone, may be made by taking

Unslaked lime (reduced to powder), 1 peck; fine white sand, or coal-ashes, 1 peck; fresh wood ashes, 2 pecks; sift all through a fine sieve, and mix well together while dry; then mix them with as much linseed-oil as will make the whole thin enough to work freely with the brush.

The expense of this preparation is very little.*

6. *A fawn-color* can be made from No. 5, by adding yellow-ochre and Indian-red.

7. *A drab-color* is formed from recipe No. 5, by adding burnt umber, Indian-red, and a little black.

8. *A dark stone-color* is formed from recipe No. 5, by adding lamp-black.

9. *Brown stone-color* can be made from recipe No. 5, by the addition of Spanish-brown.

These paints, Nos. 6, 7, 8, 9, are cheaper than common oil-paint. They should be applied in two coats—the first thin, the second thick.

10. *A white milk-paint* may be made, where it is objectionable to use oil, by taking

Fresh-slaked lime, ½ lb.; Paris-white, 3½ lbs.; skimmed milk (sweet), 4 quarts; linseed-oil, ½ pint. Mix well the lime with half the milk, and the Paris-white with the

* A. J. Downing.

other half; then put them together and stir well, adding the oil. It is then ready for use, and many consider it equal to oil paint. Any shade may be made by the addition of dry pigments.

11. *A white paint without oil or lead*, similar to No. 10, is made of

Whiting, 5 lbs.; skimmed milk, 2 quarts; fresh-slaked lime, 2 oz. Mix the milk gradually with the lime, and then stir in the whiting.

This paint becomes hard and is durable. This amount will cover nearly sixty square yards.

12. *A white paint for old houses.* Take

Water, 3 gallons; flax-seed, 1 pint; boil half an hour; take it off, and add water enough to make 4 gallons; let it stand to settle; pour off the water in a vessel, and put in Spanish-white to make it thick as whitewash; then add ½ pint linseed-oil; stir well, and apply with a brush.

13. *A black paint for iron* is made by

Mixing lamp-black with carriage rubbing varnish; or simply coat the irons (of fire-places, mantels, etc.) with black Japan, as used by carriage-makers.

14. *Paint for floors* is made of

White lead, 2½ lbs.; yellow ochre, 5 lbs.; litharge, 2½ lbs.; venetian-red, ½ lb.; *raw* linseed-oil, 1 gal.; mix well, and add Japan dryer. Give three coats.

15. *To remove paint from wood:* Lay on a thick coating, or plaster, of fresh-slaked lime mixed with soda; next day wash it off with water, and the surface of the wood will be left clear.

16. *To clean paint:* Take whiting on a dish and moisten it with water, then rub the paint over with it, using a woolen rag for a rubber, and wash off clean with water. Cold tea-grounds are also excellent for rubbing or cleaning paint.

The quantity of paint required is determined on the basis of about 18 lbs. of lead to 1 gallon of oil, which will, on an average, cover 25 square yards, two coats thick. A third coat will require one-fourth more material, making about 1 lb. of white-lead to the square yard for three-coat work on wood. Brick work requires about four times this quantity. Ready-prepared paints are claimed by their proprietors to cover a little larger surface than this.

The cost of painting may be readily ascertained where the prices of materials and work are known, which vary in different localities. White-lead will average 12 cents per lb., and oil $1 per gallon. Some allowance must be made for other articles used.

Applying the paints is estimated by the square yard; or, where the contractor furnishes the materials, he estimates the job completed at so much per square yard.

STAINING.—The object of this process is to preserve the natural graining of wood, and to bring it out with heightened effect and beauty. This is frequently preferred to the imitation of the grain of wood with oil or distemper painting. The process is simple and economical, and, where the wood has the proper natural grain, the effect is very pleasant. Stained wood should be finished with a coat of varnish, or French polish. The latter is

used when the work is very fine and near the eye. The color of a stain should be tried on a piece of wood before being applied to the work to be stained.

1. *The natural color* of any wood, as pine, oak, walnut, etc., may be enlivened, and the grain brought out, by applying a light coat of shellac, and then two or three coats of good varnish; or by simply applying successive coats of varnish.

2. *A black-walnut color* is made by staining pine, or other light wood, with asphaltum, thinned with turpentine. To give it a reddish tinge, add a little burnt sienna, or Venetian-red. Or,

3. *A black-walnut color* may be given to lighter wood by first applying evenly over the parts to be stained a solution of sulphuric acid (mixed in the proportion of 1 oz. sulphuric acid to 1 pint of warm water), put on while warm. Add two coats of tobacco stain, applied with a sponge or piece of flannel; the stain being made of 6 lbs. common shag, or "negro-head," tobacco, boiled slowly in as many quarts of water as will cover the tobacco, and, when at the consistency of sirup, strained ready for use.

4. *Walnut stain*, either black or of reddish tint, may be made of burnt sienna and burnt umber, mixed with sour beer. To make the color black, use a larger proportion of umber; to produce a reddish tint, use a larger proportion of sienna. Put on with a brush, and then varnish.

5. *An oak or maple-color* can be produced with recipe No. 3, only making the solution of sulphuric acid much weaker, and applying but one coat of the stain.

6. *A mahogany-color* may be obtained by staining the wood with nitric acid, diluted in ten parts of water, the stain being applied with a sponge tied to a stick, to prevent its getting on the hands.

7. *A rosewood finish* is produced by graining the stained wood with burnt umber, and glazing over with carmine.

8. *A rosewood grain* is made by giving the work one coat of red-lead and Venetian-red, equal parts, mixed with equal parts of oil and turpentine; when dry, rub well with sand-paper, then give the work one coat of asphaltum, and run drop-black in with a flat brush, to imitate the grain.

9. *A black stain* is made by boiling 1 lb. logwood in 4 quarts water, adding a double-handful of walnut-peel or shells while boiling, then strain, and add 1 pint best vinegar. Apply while boiling hot.

10. *A bright-yellow stain* is made by merely putting a small piece of aloes into the varnish used.

11. *A brown color* is made as follows: First coat—1 part of catechu (Gambier) boiled in 30 parts of water, with a little soda added. Apply; and, when dry, add second coat, consisting of 1 part bichromate of potash, and 30 parts of water. The shades of the color will be according to the strength of the solutions.

VARNISHING.—Varnish serves both to beautify the appearance of any work and to preserve it from decay. A coat of paint intended to be varnished should be put on *flat*—that is, using a large proportion of turpentine in the mixture. The coat of paint, or first coat of varnish where no paint is used, should be rubbed down even and smooth with pul-

verized pumice-stone, applied with a piece of old wool hat. It is well to keep the work wet during the rubbing. When dry, apply the other coats. Great care should be taken to spread the varnish on evenly; but, remember, the quicker varnishing is done the better the job, as that gives the varnish time to flow together, without leaving brush-marks.

1. *Copal varnish* is extensively used, and makes a pleasant finish. It is thinned, when necessary, with turpentine. In outside work, the durability of this varnish is increased, and its tendency to crack diminished, by adding to it a small proportion of boiled linseed-oil. This varnish is also used for furniture.

2. *Shellac varnish* is made by dissolving 2½ lbs. gum shellac in 1 gallon best quality alcohol. Put in a vessel together, and set away in a warm place. The gum will dissolve in a day or two, when it will be ready for use. The effect of the shellac is to slightly darken the shade.

3. *Outside varnish*, exposed to the weather, must be of the best quality, and properly applied. For this purpose none is better, perhaps, than coach varnish, such as is used for polishing carriages, etc. Another article of good quality is the "*wearing body varnish*,"* which works freely, dries hard, and makes a brilliant and durable finish.

4. *To revive old varnish*, take ¼ oz. alcohol, ½ oz. muriatic acid, 8 oz. linseed-oil, 1½ oz. butter of antimony, ½ pint best vinegar; mix well, putting in the vinegar last. Use as other varnish.

5. *Varnish-brushes*, when not in use, should be suspended in the manner mentioned for paint-brushes (without the brush touching the bottom of the vessel); but not in *oil* or *turpentine*, for the latter, especially, destroys the elasticity of the brush; much less in *water*, for it not only injures the brush, but converts the varnish adhering to it into a hard, resinous substance, which is ever afterward working out into the varnish, greatly to its injury. The brush is best preserved by suspending it in varnish, but it may first be cleaned with turpentine.

Fresco Painting.—In this department of the art, the colors are mixed with water and a glue size. This kind of painting is done on fresh-laid plaster walls, may be made highly ornamental, and requires an artist of taste and experience to execute it successfully. As such an artist must be employed for such work, it is unnecessary for specific directions on the subject to be given here. It makes an elegant inside finish for a church when brilliant and flashy colors are properly restricted.

Calsomining.—This is an economical mode of painting plaster walls, and yet may be executed with fine effect. It differs but little from fresco work, except in its application. It can be put on either smooth or rough walls, though the smooth are better, and then can be removed when desired. The purest white, or any tint or shade whatever, can be given. The same *dry colors* are used as in oil, but Spanish-whiting, or Paris-white, or zinc-white, is made the basis, instead of white-lead.

* "How to Paint."

The first requisite is to have the walls perfectly clean—free from grease or lime. A coat of paint, or thin size, on the wall will be an advantage. All cracks and holes are to be filled with putty, or plaster Paris. The paint is to be applied while warm, and with a whitewash-brush of the best quality. A solid appearance is given the work by running the brush in every indiscriminate direction, instead of only one way. A coat of varnish may be added, if desired.

1. *White color*, for common work, is made by mixing 10 lbs. of Spanish (common) whiting with 1 lb. white glue, dissolved in warm water. Mix the white to a thick cream with warm water, then add the dissolved glue, and stir well together.

2. *White color*, for fine work, is made in the same manner as No. 1, except that zinc-white, or Paris-white, should be used in place of whiting.

3. *A flesh-color* is produced by taking recipe No. 2 as a basis, and adding burnt sienna.

4. *A pink tint* is given by adding Venetian-red to No. 2.

5. *A purple color* is made by adding ultramarine-blue and Indian-red to No. 2.

6. *A straw-color* is made by adding yellow-ochre to No. 2.

7. *A buff color* is made by adding yellow-ochre and a little Venetian-red to No. 2.

8. *A lilac-color* is made by adding Indian-red and a little drop-black to No. 2.

9. *A light-drab* is made by adding burnt umber and yellow-ochre to No. 2.

10. *A pearl-white* is made by using drop-black, ground, and a small quantity of Venetian-red with No. 2.

11. French gray is made by adding a small quantity of indigo to the white paint.

Two coats of any of these preparations will be sufficient. The quantity of materials specified in No. 1 will calsomine 50 or 60 square yards, and cost about $1.50.

12. *White milk-paint*, for plastered walls, is made by taking ½ lb. fresh-slaked lime, and mixing in an earthen vessel with 3 quarts of sweet skimmed milk. Then, in another vessel, mix 3½ lbs. Paris-white with 3 pints milk. Put together, and add ½ pint linseed-oil. When well mixed it is ready for use. This paint makes an excellent wall finish. Any shade or tint may be obtained by the addition of dry pigments. This is about the same as No. 10, page 53.

13. *To remove calsomining*, take warm water and a sponge and rub it off.

WHITEWASH is a class of paint commonly used on rough outside work, but may be made to give a neat finish not only to outside dressed work, but also to plaster walls inside. The surface to receive the wash must be clean and dry.

1. *Outside wash for wood* may be made as follows:* Take a clean barrel that will hold water, slake ½ bushel of lime in it by pouring in boiling water sufficient to cover the lime 4 or 5 inches deep, and stir till well slaked. Add sufficient water to bring to the consistency of thick whitewash, and stir in 2 lbs. sulphate of zinc and 1 lb. common salt.

2. *Cream-color* is obtained by adding 3 lbs. yellow-ochre to recipe No. 1.

* "The House," by Jacques.

3. *Fawn-color* is had by adding 4 lbs. umber, 1 lb. Indian-red, 1 lb. lampblack to No. 1.

4. *Gray, or stone-color*, may be made from No. 1, by adding 4 lbs. raw umber and 2 lbs. lampblack.

These washes are easily applied with a common flat brush, and are quite durable when the work is properly done.

5. *Whitewash for wood, brick, stone, or plaster:* Slake in a barrel ½ bushel of lime, by pouring boiling water on it, keeping the barrel covered during the process. Strain the solution, and add a peck of common salt dissolved in warm water, 3 lbs. ground rice, boiled to a paste in water, ½ lb. powdered Spanish-whiting, and 1 lb. clear glue dissolved in warm water. Mix well together, and let stand for several days. Apply as hot as possible. Any tint or shade may be given by the addition of the desired color in powder. This wash is considered nearly as good as oil paint, yet it is much cheaper.

Whitewash brushes, after being used, should be washed clean in water and kept dry.

PAPER-HANGING.

This manner of ornamenting and preserving plaster walls is receiving more attention than has been hitherto bestowed upon it. With the exercise of good taste in selecting colors, tints, and shades, and a careful, honest hanging of the paper, a beautiful and durable finish may be given to churches, school-houses, and residences. A skillful and practiced hand can paper the audience-room of a church in such style as almost to equal in effect the most elegant fresco work. Many of our churches, newly-built, would present a far better inside appearance than they do, with their cloudy, stained, striped plastering, if they were nicely papered. And not a few of our old churches, whose walls are full of cracks and covered with the dirt which has accumulated upon them during a score of years, would be so improved by a coat of papering as to appear like a new place. For the advantage gained in papering old houses, where there are already plastered walls, the expense is quite small; and if there should be some careful hand in the neighborhood, who can put on the paper, which is very frequently the case, the expense would dwindle to a very small sum. With the aid of the taste of the ladies and of the paper-seller, appropriate colors and figures can be selected. Light tints and small, modest figures are preferable for walls, and white for the ceiling.

The cost of papering new work, including the ground-work of plastering for it, is but little, if any, more than the cost of a three-coat job of plaster, and can be made to produce a better effect than any plain plastering will do. A good article of paper can be had for 20 or 25 cts. per roll, containing 30 to 36 square feet; and the hanging, when done by a professional hand, costs the same as the paper. The ceiling may be prepared for paper by putting on one good coat of brown plaster, well troweled. The walls may be made two-coat work—a thick brown coat, and a very thin white coat. In old walls, the cracks must be filled with putty or plaster Paris, and carefully smoothed over, leaving no irregularities to show through the paper. If the wall is dirty, or has been whitewashed, it must have a coat of *size*, to make it hold the paper.

Size for papering is made by dissolving 1 lb. of glue in 10 gallons hot water. Apply with whitewash-brush, touching every part, especially the top and bottom of the walls. As soon as dry the wall is ready for the paper.

Paste for papering: Take 5 lbs. of flour and beat into a stiff batter, with clear, cold water. Pour boiling water slowly on the batter, and stir briskly. When about the right consistency, the batter will be observed to swell, and its white color change to a yellowish hue. This makes a fine, smooth paste, suitable for any description of papering.

Papering whitewashed walls is also done by making flour starch, as for starching clothes; with whitewash-brush wet the walls with the starch, and let it dry. And then, in putting on the paper, wet both wall and paper with the starch.

Handling paper must be done with care and neatness. The blank strips are to be cut from the left edge of the paper with sharp scissors, the blank strips on the other edge forming the lap. Where the paper is very thick, cut both edges without lap. Cut the paper the desired length, with an extra inch at the bottom to trim off evenly after it is on, to make a nice finish. Lay the paper, with face down, on a clean, smooth table or board, and apply the paste evenly and quickly with paste-brush, or whitewash-brush. Fold up the bottom of the paper with one large fold, the sides with the paste being together, to make it convenient to handle. Place it in position on the wall, commencing at the top, and, being careful to match the figures, pass the cloth or wisp broom, with which you rub down the paper, down the middle of the work, rub to each side from the middle, smoothing out all the blisters; and, when the paper is smooth, touch it no more. Then cut out and paste on the borders, centers, and other figures.

To varnish papered walls, give first a coat of isinglass, or clear white glue—strong coat; and, when dry, varnish with clear, white Demar varnish—one or two coats, as may be desired.

The greatest care is required throughout to keep the paper clean. The beauty and effect of a papered wall depend largely on the neat, clean appearance of the job.

The acoustic properties of papered walls are superior to those of hard plaster.

GLASS AND GLAZING.

There are three general classes of glass manufactured for architectural purposes—the *plain, stained, and cut.* There are numerous varieties belonging to each class, of which it is not necessary to speak at length.

Plain glass, for windows, is generally of either single or double thickness, the former being sufficiently strong for usual sized windows. The quality of glass also varies, especially in reference to transparency—some being perfectly clear, and allowing a natural view of objects through it, while others obscure and distort the view. The European manufacture of glass is esteemed of superior quality by many; but, altogether, it is not to be preferred to the American make. Glass should be as large as possible, not to depreciate in strength, its length being about twice its width; for it owes much of its beauty to

the size of uninterrupted surface it presents to the eye. Plain glass is cheaper than the other kinds, but generally requires shades, blinds, or other obscuring, to temper the light passing through it, and destroy that very objectionable glare which must otherwise be met. In this way its expensiveness is increased.

Stained glass, as its name implies, is made by applying paints to plain glass. This art has been carried to a great degree of perfection, not only in the selection and combination of colors to produce a given effect, but also giving great durability to the work; thus bringing together the highest order of ornamentation and practical service. The paint is put on one side of the glass, from the "plain obscured" to the most elaborate design, and then, by the application of heat, it is burned into the glass—vitrified—and made permanent. The painted side of the glass is put *in*, which allows but little exposure to weather; and, to an inside view, it appears in all the brilliancy of the colors employed, each tint and hue being brought out in full effect. This sort of window affords sufficient light for a church, and at the same time prevents its excess without the use and expense of shades and blinds.

Any figure, design, or color preferred, can be made by the stainer. By applying to him, giving a description of the house under construction and the character of the work desired, patterns, prices, etc., will be furnished, so that a definite estimate can be made of the cost. Wm. F. Blum, of Louisville, Ky., and John Hughes, of Memphis, Tenn., are perfectly competent artists, and do all classes of work. Mr. Blum has executed the glass work of some of the most elegant churches in the West, among them the Broadway Methodist and the Rev. Dr. Stuart Robinson's, in the city of Louisville. Mr. Hughes has specimens of his work in some of the best churches that have been built in Memphis and its surrounding towns and villages. Nice, stained window-glass, with approved pattern, can be furnished by them at 75 cts. per square foot. Prices range from 50 cents to $2, and upward.

Cut or ground glass is made by a different process. The figures are *cut* into the glass, making them permanent beyond question. The *obscuring*, as a groundwork, is done by putting the glass in a large box, one surface resting closely on the bottom of the box. The glass is then covered with gravel, which is kept wet with water. A motion is given the box by machinery, each end rising and descending alternately with the other, producing a continual passage or rubbing of the gravel over the upper surface of the glass, till it is evenly and nicely obscured. The design is then penciled on the glass, and the figures ground out with a grindstone which is imported from Europe and has a very fine grain. The figures are then highly polished, and sometimes colored. Solid colored glass—green, yellow, blue, etc.—is *figured* in the same manner as ground glass, the figures being made perfectly transparent. The most ornamental designs may be executed in this way. The work is unsurpassed in brilliancy. Those who prefer this sort of glass, may obtain all desired information as to designs, patterns, cost, etc., by applying to Wm. Coulter & Son, of Cincinnati, who make church-work, in this line, a specialty, and do it well.

Etching on glass is a simpler way of making figures on it by the use of a strong acid. In this work, draw the figures and ornaments with asphaltum, made three parts of spirits of turpentine and the other part good Japan dryer and copal varnish; flow it on heavy, and leave such parts exposed as you wish to be operated on; let it stand 24 hours to dry; then

surround it with a cord soaked in beeswax, and lay it around the glass, to keep the acid from leaking or running off over the edges; then pour on flouric acid, and let it remain from 6 to 24 hours, according to the depth to be cut. Pour off the acid, wash the glass with a little water, and remove the cord and wax; wash off the asphaltum with a little alcohol, and the work is done.* If desired, the figures thus formed may be gilt. In either case, the effect is very pleasant.

Grinding glass in a simple and cheap manner, so as to increase the effect of etching, is done by the following process: Take a wide, thin piece of brass, and make it cover the figuring; and then use emory, and keep it wet with water. The surface is thus ground to the appearance of fine frosting, while the figures are left clear.

To imitate ground glass. Dissolve ¼ lb. gum arabic in a pint of boiling water, and add whiting until the mixture is of the consistency of gruel or stiff paint. Then, with a sponge dipped in the mixture, daub or pounce the glass over, on the inside, until a smooth or even surface is obtained; then lay a rule or "straight edge" across the glass, and with a pointed stick mark off the clear lines desired.†

To preserve glass from the rays of the sun, use finely-powdered gum tragacanth dissolved 24 hours in the white of eggs well beaten up. The mixture is gently applied with a brush to the exposed surface.

Frosting on glass may be done by either of the following modes:

1. Mix 2 lbs. white lead and ½ lb. patent dryer with a little coach varnish, bring to proper consistency for use with equal parts of oil and turpentine. Apply a thin coat with a brush, and then pounce it with a piece of cotton cloth in the form of a ball; that is, bring the ball straight down on the painted surface and raise it directly up again.

2. Take 2 lbs. zinc, ½ lb. patent drier, 1½ oz. sugar of lead, mix with oil, and apply as in No. 1.

3. A very light frosting is made by taking a ball of putty, moist with oil, and pouncing the glass over with it. This will prevent any one seeing through the glass.

Borders may be drawn on the glass with a sharpened stick from one to two inches from the edge. Other figures may be made in the same way.

Glazing, or putting glass in the sash, requires care and neatness. The sash should invariably be well primed before the glass is put in. The panes must be fastened with small brads or sharp-pointed bits of tin before being puttied.

To remove old putty from sash, run a red hot iron of square shape along the putty. This softens it and takes it off.

To remove paint from frosted or painted windows, take a strong solution of potash, or concentrated lye, soak with it three or four hours, and scrape off with a case-knife or any sharp iron. Then wash with clear, cold water till clean.

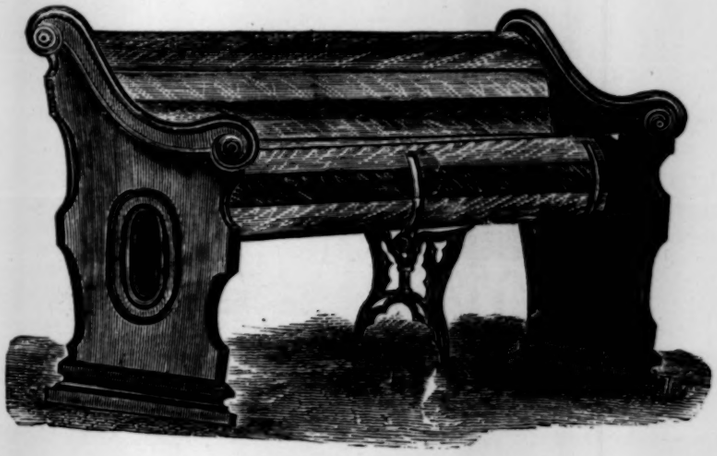
Painting sash is a tedious work, but must not be slighted. If great care is not taken, the glass will be smeared with putty and paint. A small, soft brush is best for tracing. No color is better than white, and no paint preferable to white lead, or zinc, with linseed-oil and turpentine.

* McDonnell's "Practical Painter." † Gardner's "How to Paint."

CHURCH-PEWS.

A COMFORTABLE seat in church is always highly appreciated. The idea that a person is to do penance during the time of public worship, by sitting on a hard, rough, ill-shaped pew, when he is able to provide one of ease and comfort, finds comparatively few supporters in these days. Such bodily suffering does not tend to improve piety or spiritualize worship. There is no attraction in it for the wicked to bring them to the house of God. That the people, in the early history of the Church, and even as late as the 14th century, are represented as sitting on the floor, or standing in their churches; or that, in the following century, stone benches, projecting around the wall, or low wooden stools scattered over the floor, constituted the seating accommodation of churches; or that "slab" benches were used by our fathers, and are now in use by many good people who cannot afford better, cannot amount to an argument in favor of our adopting the same arrangement, when we have abundant means to provide a pleasant and elegant seat, such as some of the improved patterns made by the Excelsior Church and School Furniture Company, of Cincinnati, Ohio, and other good companies engaged in this sort of manufacture.

Careful and extensive search has been made by us to obtain the best possible model for a pew, combining the greatest number of advantages and the most comfort. After examining and *trying* those made by the company above mentioned, we can pronounce them superior to any others known to us. The annexed cut represents the "*Excelsior Pew*,"

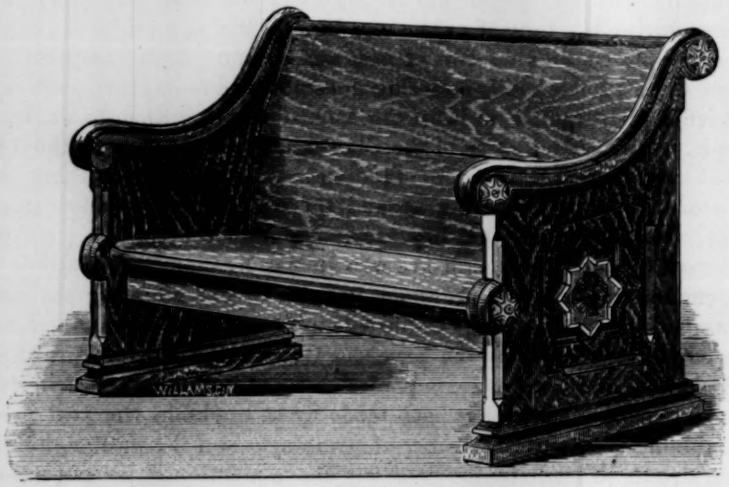


No. 1.

which affords great ease and comfort to the occupant. The seat and back are made of narrow slats, and curved to fit the form of the person, so that the pressure on the body is equally distributed over the entire surface in contact with the pew. An additional advan-

tage is that the seat folds or raises up, to allow easy passing, sweeping, etc. There is no necessity for cushioning.

No. 2 is a less expensive pew, yet very desirable. It has a curve, or, rather, an angle, in the back, which adds much to its comfortableness. The seat is flat, and may be cush-



No. 2.

ioned or not, as preferred. This style is plain and well adapted to general use. It will be acceptable to any congregation.

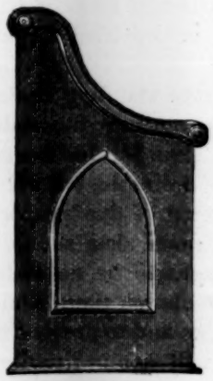
A settee for Sunday-school use is represented in No. 3. It is quite convenient indeed,

No. 3.

being reversible and having curved slat back and seat. The rack underneath for hats is a desirable addition.

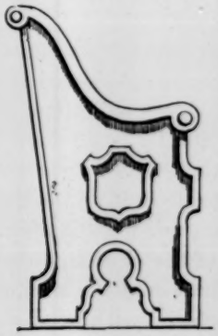
By reference to the parties mentioned (whose announcement will be found at the close of this volume), an illustrated catalogue of church-furniture, prices, etc., may be obtained, which will enable building committees to select the form of pew desired, or any thing else required in furnishing the church.

Those who are compelled to make their own pews, or who prefer to have them made to order, may find a desirable model for a pew end in those here given. No. 4 is the plainest and cheapest, but may be made even plainer by leaving off the panel. No. 5 requires more work and presents a better appearance. The work on No. 6 is still more elaborate, and



No. 4.

No. 5.



No. 6.

makes a beautiful pew. In figure 14½ is seen an elegant pew end, with a view of the form in which the pew should be constructed. It represents a paneled back, with book-rack. The back can as well be made plain. The body of any of these styles may he oak, ash, or pine, stained or grained, and the trimmings walnut.

It will be well to observe the following dimensions and proportions in the construction of pews. The *seat* should be 14½ in. wide, 1¼ in. thick, the front edge 16 in. from the floor, and the rear edge 1½ in. lower than the front. A pew over 7 or 8 ft. long should have a middle support. The *back* must be 1 in. thick, and 17 in. high, exclusive of the rail on top and the 1¼ in. at the bottom to cover the rear edge of the seat. The slant of the back out of a perpendicular should be 1½ in. for 8 in. up, and 2 in. more for the other 9 in., making the top of the back 3½ in. farther out than the bottom. This plan requires the back to be in two pieces, closely jointed with tongue-and-groove. The angle thus made is an important feature in the construction of a comfortable pew. It will also be an improvement if the seat is made of slats 1¼ in. thick by 3 in. wide, 1 in. apart.

A good thickness for pew *ends* is 1½ in. to 2 in., and the full width required is 17½ in., allowing the seat to project 2 in. in front, and itself to project ½ in. beyond the top of the back. The seat should be let into the end, and then well fastened. The *brace* under the seat may be 6 in. or more, as preferred.

The painting, staining, and varnishing pews, so as not to allow any injury to clothing in contact with them, can be accomplished by being very careful to use plenty of dryers, and then being sure that each coat is thoroughly dry before another is applied.

The arrangement of pews in the church next requires attention. The distance which pews should be placed apart, in order to afford convenience and comfort, is 18½ in.—that is, 36 in. for the pew and the space in front of it—3 ft. from back to back of pews. Less

space than this makes it inconvenient to get into the pew when the first comer takes possession of the outer seat, which is generally done. A narrow space also interrupts the form, and thereby not unfrequently the spirit, of worship, by not giving room to stand or kneel. Too often does it look as if the congregation were "too proud to kneel, and too lazy to stand." A cramped pew encourages the evil. If a particular form of worship is adopted by any denomination, let the observance of that form be provided for, and thus encouraged.

Aisles should not take up unnecessary room. The aggregate standing room of the aisles should not exceed that of the doors. It is unnecessary to get into the aisles faster than the doors will allow the people to pass out. We do not mean by this to encourage extraordinarily large doors. An *easy* egress from the church is desirable, but it is seldom indeed that a *quick* egress is required. The doors, therefore, being of due proportions, it is easy to determine the number and width of the aisles. No main aisle should be less than 3 ft., nor need it often be more than 4 ft. wide. There ought to be no aisle in the middle of the church, directly in front of the pulpit. In a large church there is an advantage in one next the wall, especially to give access to the windows and to prevent the walls being defaced with head-marks. A church 25 to 30 ft. wide will not ordinarily require more than two aisles, each 3 ft. in width; one 35 to 40 ft. wide, two aisles, each 3½ ft. in width; one 45 to 50 ft. wide, four aisles, two of which should be next the walls. Design No. 10 is 51 ft. wide, and has four aisles, the two next the walls being 2½ ft. wide, and the others (10 ft. from the outer aisles) 3½ ft. in width. More space than this may be devoted to aisles if there is no other use for it. Better be cramped in the aisle for a few moments than in the pew for one or two hours; but it is best to have plenty of room in each.

The system of free pews is the best. It should be adopted wherever "practicable." And where the pews *must* be rented, alternate ones should be reserved and kept free, so that no distinction be made in the house of God between those who possess little of this world's goods and those who have more.

THE PULPIT, PLATFORM, AND ALTAR.

The *pulpit* is not only a conspicuous object in the church, requiring conformity in its design to certain esthetic principles, but has to be made with reference to the ease and comfort of the speaker who stands behind it. Quite a number of models are given in this volume, all moderately plain and simple, in keeping with the churches for which they were intended. Fig. 6 represents a cheap pulpit, simple, but making a neat appearance. It may be made of 2 in. by 10 in. stuff, as shown, with the top 14 in. by 28 in., a book-board 12 in. by 16 in. and 3 in. slant. Fig. 41 is also a cheap pulpit, while figs. 30, 38, 39, and 40, are models of more work and greater expense. The style and finish of a pulpit

should correspond with the church and its other furniture. If the seats are oak or yellow pine-grain with walnut trimmings, so should be the pulpit.

The size of the pulpit is now generally and very wisely reduced from its former proportions. It is considered sufficient to provide for Bible and Hymn-book, without inclosing the preacher with a huge wall. A good height for a pulpit is from 32 to 34 in., exclusive of book-board.

The platform, or floor, of the pulpit must have a proper height, to enable the audience to hear and see the speaker, and the preacher to deliver his discourse with ease to himself and due effect upon his congregation.

A safe *rule* by which to determine the height of a platform is *first to deduct* 10 *from the full length of the house in feet, and after that raise the platform* ½ *in. for every remaining foot.* In a church 60 ft. long the platform for the pulpit should be 25 in. high. This subject is considered more at length in the article on "Acoustics," to which the reader is referred.

The altar forms an important part of a well-arranged church. The ends which it subserves claim our attention and require special provision to be made. Its uses among Protestant denominations are well understood by all, and need no advocacy here. Each design presented in this Manual contemplates an altar; that is, a low railing, or inclosure, in front of the pulpit.

No particular instructions are necessary on the subject, farther than are given in the plans and specifications for each design. The front portion of the altar should not be too far removed from the pulpit: 5 ft. will ordinarily be sufficient space. A circular railing, 2 in. by 6 or 8 in., supported by balusters, makes an altar of neat appearance; as in Fig. 23 of Design No. 6. The circular form, however, is more expensive than if made in straight lines, as in Fig. 2. The height of the altar should be 18 in., with a knee-board on the outside 12 in. wide, 2 in. high at outer edge and 3 in. at edge next the altar, covered with carpet or a cushion. In a church over 50 ft. long the floor inside the altar should be raised 5 or 6 in. above main floor. An opening, or door on hinges (same construction as the altar), made in the front part of the altar, swinging inwardly, will make it convenient to pass out of the altar without going around, as is usually done.

Pulpit and altar furniture, chairs, sofas, cushions, etc., can be obtained from Mitchell & Rammelsburg, Cincinnati, Ohio, who have one of the largest and best furniture establishments in the United States.

THE CHOIR—ITS PLACE.

WHERE a church has a regular choir—a body of practiced singers to lead the congregation in this part of worship—its place should be determined, and such special arrangements made as will promote this interest. While the music, or song, of the church demands certain restrictions, to prevent the introduction of that which is inappropriate to the place, and productive of other than religious effect, it needs also all possible encouragement in the right direction. The end to be reached is that "all the people sing," and sing "with

the spirit and understanding." That this might be accomplished, David had his "chief musician" to instruct and lead the multitude of singers in the temple of the Most High. Hezekiah and Ezra adopted the same plan—a plan as good now as then, and must have been contemplated, in part at least, by Mr. Wesley, when he enjoined, "In all our congregations let the people learn to sing,"* which means not merely to sing, but to sing properly. "It is impossible to read those passages in the Old Testament which treat of the singers and of the leaders of song in the sanctuary, without reaching the conclusion that *good* music was contemplated. We can be satisfied with nothing short of good bread to eat, good water to drink, good raiment to wear; we want a good prayer and a good sermon. How, then, can we be indifferent in regard to the music which is to be used in the worship of our Heavenly Father?"†

"God has bestowed on our race, in addition to the faculty of speech, the gift of music, as a medium of communion with each other and with himself; and has appointed it as a means of the sublimest exercises of devotion, as if with special intent that the praises in his Church on earth may approximate as nearly as possible to the spiritual and refined worship of the Church in heaven. Through the influence of music the very senses become, as it were, handmaidens of devotion. By the harmonious combination of a few notes, with their various modulations, the mind, through the organs of hearing and the sympathy of the nervous system, not only receives peculiar pleasure—sometimes exquisitely refined sensations of delight—but the affections are excited to the spiritual exercises of devotion and praise; we are prepared for the more lively and ecstatic enjoyment of divine communion, and are thus assisted in near approaches to the throne of grace."‡ Therefore, "music should be cultivated for the purpose of religious worship, and from a sense of a religious duty."

"If a congregation is so fortunate as to enjoy the services of a choir of good singers, who sing not for display, but for worship, and who are willing to assist the humblest worshipers in the sanctuary, and even children, in making their praises vocal, the Church should, by all means and most thankfully, avail herself of such assistance."§ But the choir should be composed of such persons as esteem the good of the Church more highly than the attainment of some selfish end; and who, therefore, will not construe the suggestions of the authorities of the Church as indicating their want of gratitude for such services, or as interfering where they have no right. Indeed, it should be well understood from the beginning that this branch of the worship, as well as any other part of it, is under the supervision of the pastor, aided by his proper "advisers." Although he may not be a scientific musician himself, yet he will be able to determine whether the music is "good to the use of edifying," and whether it "ministers grace unto the hearers."

But the feature of this subject most difficult of solution to many congregations is, whether or not an instrument shall be used by the choir. We will not undertake to settle this question, for it is a matter which each society may settle for itself, as it is a question to be determined mainly on the basis of propriety, utility, and taste. It is admitted that the instrument is serviceable as an accompaniment to the human voice, both in teach-

* Discipline. † "The Service of Song," by the Rev. A. G. Stacy. ‡ Freeman. § Furber.

ing and singing, ordinarily; but the question is, Do the same rules, or different ones, apply in Church-music? There is neither Church-law nor "thus saith the Lord" enjoining or prohibiting the use of an organ in connection with congregational singing. If the choir would bear in mind that it is highly reprehensible to pervert either the voice or instrument (*either one*) from its appropriate use in public worship, there would be much less opposition to choir and organ than there is. And if those whose extreme conscientiousness on the subject brings them to an obstinate and refractory stand against the rest of the Church would concede a little more, in this matter of *opinion*, to the judgment of other good men and women, and for the peace of Zion, much trouble and evil would be avoided. Persons eminent for learning, piety, and devotion to the cause of God, have differed on this subject, and will, no doubt, continue to differ; but this is no cause, neither should it be made the occasion, of trouble.

Cabinet organs are better for small churches, as they occupy less space, and may be easily moved. Their cost is from $100 to $500. Among the most reliable instruments are the Estey Organs, sold by D. H. Baldwin & Co., Cincinnati, Ohio, and the Prescott Organs, sold by Edward Nennstiel, St. Louis, Mo. These are excellent reed instruments, well suited to Church or Sunday-school use. The "Cabinet Pipe Organ," manufactured by the Cabinet Pipe Organ Company, Syracuse, N. Y., is a combination of pipes and reeds, as represented by the cut in the Appendix to this work. It is of good tone and fine appearance.

For large churches, the regular pipe organ is preferable, which can be built to cost from $400 to $50,000. Their manufacturers, or agents, are to be found in most of our large cities.

But where shall the choir, and organ, if used, be located? Its place is where the objects intended will be readily accomplished. If the choir is to *do* the singing *for* the congregation, the gallery is an *admissible* place for it. Sometimes a gallery-choir does very well, but generally the congregation will have to endure a number of evils for the sake of having their singing *well done*. If the choir is to be *seen*, it ought not to be placed where the spectators are put in a break-neck attitude to see. If it is to be *heard*, it ought not to be *back* of the congregation, for the construction of the ear, and also our experience, teach us that hearing is better from the side or front. If the choir is to *lead* the singing, its object will be poorly accomplished *from the rear*. The gallery is the poorest place of all others for a *Church-choir*.

A location on the main floor, but somewhat elevated, brings the choir into the congregation, where it can be better seen, heard, and followed. This is the arrangement in Des. No. 4, with railing around the platform, and a step in the rear. Where a pipe organ is used, it should be placed on the rear of the platform, facing the pulpit.

To the right or left of the pulpit, or directly in front, or on a platform immediately in its rear and fronting the congregation, a choir may greatly encourage and aid congregational singing. In Des. No. 10, the recess in rear of the pulpit is occupied by the choir, with a large pipe organ built for the place, as shown in Fig. 38. This arrangement of the organ gives a handsome appearance to that end of the room, and secures, as effectually as any other plan, the benefits of a choir. In large churches this is, probably, the best arrangement that can be made.

THE ROOF.

A ROOF of wide span is difficult of construction when made self-supporting, as all church-roofs should be made. It is unnecessary, however, and indeed very objectionable, to have an audience-room disfigured with pillars supporting the roof. It need not be thought impossible to construct a roof with a span of thirty, forty, or fifty feet, when acres of ground are sometimes covered in on the self-supporting plan. There can scarcely be any object in the room more objectionable to the congregation and preacher than these pillars; and they are none the less objectionable when used to support a second story over the church, as when the Church-people unite with Masons, Odd-fellows, and others, to build a church and hall together. These Orders are highly deserving in their objects, but the Church subjects itself to great disadvantage in uniting with them to build a house. Where such union *is* necessary, the construction of the house should be such as to give the Church party its proper arrangements, and full height unobstructed. But these pillars are often introduced in small, one-story houses, and one of them (four times as large as necessary) is generally placed immediately before the speaker's face. This is done to support a roof which had much better support itself.

A properly constructed "truss," or "principal rafter," will remedy the evil. Our designs for churches of medium size and upward contemplate no other plan for a roof. If the directions given are carefully followed—good material used, close, solid work done, and principal joints secured with iron bolts or bands—the result will be satisfactory in every instance. The most important point to guard is the lateral thrust, or outward pressure on the sides. Fig. 1 represents a roof where the rafters are each framed on the truss plan, and put the usual distance apart. For a small house, 28 or 30 feet wide, this roof may be made of 2 in. by 6 in. stuff, spiked with 30-penny nails. It should be from $\frac{1}{3}$ to $\frac{1}{2}$ pitch. In Fig. 30 the truss is used, with purlins, bolts, and bands taking the place of nails in the former plan. The strongest roof is seen in Fig. 10. Fig. 9 is an ornamental roof—what is called an open roof—but sufficiently strong for a small house. For a long span, more timbers should be used to bind together and strengthen the rafter and tie-beam. This roof is not as desirable as some others. Fig. 19 is a strong roof, and may be made highly ornamental. It should be made of seasoned lumber, with close, solid joints, and one-half pitch.

For dimensions of timbers, etc., see specifications; and for rules of measurement, see page 40. *A rule* is here given for calculating rafters, braces, etc., omitted in a former discussion of this subject. It is quite simple, requiring the use only of a framing square. To ascertain the length of a rafter, and the exact line in which the foot and top are to be cut, lay the square upon some smooth surface. Beginning at the outer corner of the square, the number of inches (counting 1 in. to the foot) on one of the arms will represent the *pitch* ($\frac{1}{2}$, or $\frac{1}{4}$, etc., of the width of the house), and the other arm half the width of the house. For example: The width of a house is 30 ft., and the pitch to be one-third—what is the length

of the rafters? and what shape the foot and top? One-third of 30 ft. is 10. One arm of the square up to the figure 10 represents the perpendicular height of the roof, 15 in. on the other arm will be the half-width of the house, and a line drawn from one figure to the other indicates the length of the rafter; the line of the pitch makes, with this line of the length, the angle at which the top of the rafter is cut, and the other line makes the foot of the rafter. This rule applies also in cutting braces.

The sheathing of a roof should be well seasoned and well nailed to make a tight covering, especially where shingles are used.

The projections should never be less than one foot, as *the guttering ought invariably to be outside and clear of the sides of the house.*

Shingles, tin, and slate, are in common use as covering. The slate, being quite heavy, requires stronger timbers in the roof to support it. It costs more, and is more durable, than the other materials. Sheet-iron is coming into use as a roofing. After examining its merits, we are free to recommend it for this purpose as convenient, cheap, and durable. A good article of it is manufactured by W. S. Belt, of Cincinnati, Ohio. The cut in the appendix to this Manual shows how it is prepared and applied. A sectional view of the crimp, or lap, is shown at *a*; *b* represents the Winslow barbed nail which is used in putting it down; *c* shows the concave lead-washer which is put under every nail, to prevent water leaking through where the nail is driven. The sheets are prepared in pieces 2 ft. wide and 8 ft. long, but other sizes can be had by special order. One coat of Lehigh brown metalic paint is given the iron by the manufacturer; another coat is necessary after the iron is put on. The same paint is furnished by Mr. Belt at 4 cts. per lb., 1 lb. being enough to repaint 100 sq. ft. This paint may he made a drab or stone color by mixing with white lead, and is also good fire-proof paint for wood.

The cost of this roofing is 8 cts. per square foot, including the fastenings, boxed and shipped. It can be put on by any mechanic easily and rapidly.

Special instructions for putting on will be given by the manufacturer. A circular containing all necessary information on the subject had better be obtained before preparing the wood-work for the sheet-iron, as less sheathing is required than for other roofing.

A roof of tin or iron should be well painted as soon as put on. This will not only preserve the roof, but give it a good appearance. The latter point is not to be overlooked. Even the flues, or chimneys, should be shaped and finished with reference to this end, for they constitute an important feature not only in the looks of the roof, but general appearance of the house.

THE CHURCH-BELL.

THE bell was invented early in the world's history, but the time of its being first brought into use is unknown. It is mentioned in the Bible by Moses, Isaiah, and Zechariah. At first bells were small in size, and used principally as an adornment to a person's garments or the neck of his horse. It is said that the Chinese used large bells in connection with their worship two thousand years before the Christian era. It is claimed that Paulinus, Bishop of Campania, A.D. 400, first introduced them into Christian churches, and that they soon afterward came into general use; and "ever since their introduction they have been highly regarded by all nations, the Turks alone excepted."

Bells of great size, weight, and cost have been made. The largest in the world is that at Moscow, the "Czar Kolokol" (emperor of bells). It was cast in the year 1734, by order of the Empress Anne; is twenty-one feet high and twenty-two feet in diameter, weighing 440,000 lbs. This bell "was originally suspended from beams, which, being destroyed by fire in 1737, permitted the heated bell to fall to the ground and break, since which time it has remained dumb." Another bell in Moscow weighs nearly 300,000 lbs., and requires twenty-four men to ring it. Its tremendous voice is heard only on special occasions.

The largest bell in America is at Montreal, and weighs 25,000 lbs. The bell in St. Peter's, of Rome, weighs 17,500 lbs., and that in St. Paul's, of London, 11,500 lbs.

But the objects of a church-bell can be accomplished at much less expense than in the use of so much metal. Ordinarily, the members of any congregation of worshipers, who rely upon a bell at all, can be notified of the hour for religious devotion by the strokes of one weighing no more than one thousand pounds, and measuring across the mouth but thirty-six or thirty-seven inches. It will cost, perhaps, 35 cents per pound, or $350 for the bell. Adding to this $45 for mountings, makes the cost of the bell complete $390. This size will serve the purposes of our largest churches, while, in most cases, the size may safely be reduced to 500 lbs., or even to 200 lbs., the last being a medium size for a suburban or village church.

The nearer the ground a bell can be placed, the farther will its sound be heard, provided there are no surrounding obstructions. In a town or city it must be above the tops of the houses, just where a properly constructed belfry places it. The bell-chamber ought to be arranged with special reference to permitting a free outward passage of the sound. The windows should be as large and open as possible, with the louvre-boards, or slats, sufficiently apart. It is necessary that this room be ceiled immediately above the windows, and have a close floor under the bell, special care being taken to prevent any leaking. If a water-proof floor of tin, iron, or zinc can be had, the belfry might be left open. This would be an advantage to the sound of the bell, but not to the appearance of the belfry. If the bell is put in place after the floor has been laid, it is best to hoist it with pully and rope from the outside.

A *peal* consists of four bells, the tones of which are set to the first, third, fifth, and eighth notes of the common musical scale. A separate ringer is usually required for each bell. A *chime* is constituted of at least eight bells, attuned to the eight tones of the diatonic scale. It is operated by a single player, the clappers of the bells being attached by cords to a manual, like that of the piano.

The best quality of bell is made of "bell-metal," composed of copper, tin, zinc and lead. Silver also formerly constituted one ingredient in this composition. Other metals are now used in the manufacture of bells, but the article produced is of inferior sounding quality.

Those desiring to furnish their church with a bell of the best quality, are referred to the Bell Foundry of William Kaye, Louisville, Ky., where they can obtain one of superior tone at a moderate price.

LIGHTING THE CHURCH.

THERE is much room for improvement in the lighting of our churches. As often is there too much light in day-time as not enough, to make the audience-chamber pleasant; while at night it is frequently so defective that the people cannot see to read the hymn, nor the preacher distinguish the faces before him. Sometimes it is impossible for the speaker to tell whether the eyes of his congregation are sparkling with lively interest in the subject he is presenting or are closed in sleep by the darkness which surrounds them. Light is a medium through which thought is conveyed and spirit communes with spirit. An audience, to be brought fully into sympathy with the speaker and the truths he presents, must be able to see clearly the features of his face, as well as hear distinctly the words he utters. The difficulty, in some instances, is owing to a deficiency in the quantity of light, but in others to a want of proper distribution. The church-builder has two points to consider specially—how much light is required, and how it is to be supplied.

Windows regulate the amount of light introduced during the day. The number required depends somewhat on circumstances. More are necessary for the purpose of lighting a house when it is surrounded by other houses, or by trees, than when standing in an open space. A greater number may be adopted when stained glass is to be used instead of that which is clear. The color of the interior walls will also have its effect. In ordinary cases, a church 60 ft. long, with clear glass and light walls, will receive sufficient light through three windows on each side, 3½ ft. wide. Additional windows, either on the side or in the front end, add more to the appearance of the building than to its lighting. Four three-feet windows to the side of a house of the dimensions given will not be too many, if stained glass, curtains, or blinds be used. The front windows cannot well be left out, for that would detract no little from the front view. They should be used, there-

fore, though they make it necessary to obscure the glass in some way to prevent an excess of light. Let there be no window in the rear end of the house to throw its glaring light into the faces of the congregation. Small, neatly-finished windows, with stained glass, in the *sides* of the pulpit recess are all that should be allowed. As in most churches there is no provision for *ventilation* except doors and windows, that subject is also to be considered in determining the number, size, and place of the openings. In order to meet the double purpose which our windows usually serve, they should be placed 2 ft. to 2¼ ft. from the floor, and 2½ to 3½ ft. from the ceiling. A space of 6 to 18 in. should be given on the outside between the top of the window and the cornice, or facia.

Lamps, chandeliers, and reflectors are the means of lighting by night. The subject is to be considered with reference to the number of burners employed, and where it is best to place them.

Ten coal-oil or kerosene lamps will produce abundant light for a church 30 by 50 ft. Where gas is used, eight burners may be so distributed as to give the same result, the gas affording more light than the oils mentioned. Larger rooms may be lighted in proportion to the figures given, the height of the ceiling being considered, as well as the length and width of the room. If the interior of the church be a dark color, additional light will be required. In churches 30 to 40 ft. wide, bracket lamps at the sides are better than chandeliers immediately above the congregation, as they afford more light by reflection from the wall, are less offensive to the eye, and cost less.

The Georgia Street Church, in the city of Memphis, built according to Des. No. 2, is well lighted in this manner, two of the bracket lamps being attached to the casing of the pulpit recess, one on each side, but so far above and to the rear of the speaker as not to throw a glare of light in his face or oppress him with heat. The arm being 2 ft. long, and jointed, the distance of the lamp from the pulpit can be varied 4 ft. No other lights are necessary about the pulpit, and these should not be put nearer the speaker than mentioned. This arrangement is also advantageous to the congregation, as they can see the speaker's face distinctly from other light in the room, without having their eyes pained and minds stupefied by pulpit-lamps, as they are usually placed within an arm's length of the speaker, and between him and part of his audience.

Another good method of lighting is shown in Fig. 38, Des. No. 10. The burners are 8 ft. from the wall and 10 ft. from the floor, giving a very brilliant appearance to that large auditorium without at all obstructing anyone's view. The pulpit-light in this church is very good, but would be still better coming from a small reflector on the top of the pulpit-recess, just in front of the organ, but not seen by the audience.

A great amount of *heat* is generated by lamps, which is not objectionable in winter, but in summer becomes quite oppressive. They should, therefore, be sufficiently elevated to avoid any unpleasant effect from this source. Let low chandeliers over the heads of the people, and especially lights on posts coming up out of the congregation, be discarded altogether. In all cases it is desirable to have some ventilating arrangement by which the heat may be borne upward and out of the room.

Reflectors are coming into extensive use, and constitute a successful means of lighting public buildings. They are adapted to burning oil or gas, and may be introduced in any

church. When these corrugated glass reflectors are inserted in the ceiling (which is the best place for them), they effectually remedy the evils of the chandelier's obstructing its blinding blazes between the speaker and his auditors. Even when the reflector is suspended from the ceiling (at the proper elevation to afford the best light), it is still out of the way of every one. Like the light by day, it comes from above, and can be easily supplied in such measure as to show distinctly every countenance present. Figs. 20 and 21 represent the two kinds of reflectors, the former being suspended from the ceiling, and the latter inserted in it. The inserted reflector provides also a good plan for ventilation. It may be so constructed as to exhaust rapidly the vitiated and heated air from the room. A church 36 ft. by 58 ft. can be well lighted with two 40-inch reflectors. These, made of the best silver-plated, corrugated glass, will cost $140 to $150; and, when provided, they will furnish not only abundant light and considerable ventilation, but contribute largely to the ornamentation of the room. Reflectors of the kind mentioned are made by Mr. I. P. Frink, of New York, who will furnish building committees with an illustrated circular, sample of glass, prices, and any other information on the subject desired. Those who use the side-lamps and chandeliers can procure all the necessary fixtures, with latest improvements, from the extensive establishments of E. T. Carson & Co., Cincinnati, Ohio, or O. F. Prescott & Co., Memphis, Tenn.

HEATING.

This subject, at least in some sections of the country, is of *vital* importance, involving not only personal comfort, but health and life. It is not enough that a church, schoolhouse, or residence, be *heated*, but *heated in the proper manner*. The heat must be uniform in degree, and conveyed through a pure and wholesome medium. Our attention is, therefore, directed to the *heater* and the *air heated*. Heating and ventilating ought to be regarded inseparable, whether considered antagonistic to each other or as mutual helps, for they are both; and in very briefly discussing the present subject we bear the other in mind.

The stove, like every other means of heating, has both its advantages and disadvantages. One advantage with which the stove in general use for heating stands credited is its *economy*, both in the first cost of the stove itself and the amount of fuel it consumes. But this point may be disputed, or offset on the score, first, that the stove is soon worn out and another one to be purchased; and, secondly, that the doctor's bill is increased proportionably to the decrease in the fuel account; and to save the extra doctor's bill an equal expenditure is required for special means of ventilation. Admitting the claim to economy, it is nevertheless an imperfect means of heating either private or public apartments. It is too cheerless for the *home;* it destroys the purity of the air, and makes it unfit for pleasant and healthy respiration, not only by depriving it of moist and invigorating tone, but loading it with carbonic oxide (an intense poison), which passes out through the open

joints of the stove, and even through its *cast-iron sides*, as one writer says, "with almost as much ease as a squirrel would through a post-and-rail fence;" it does not give to the air in a room a uniform temperature, and therein fails to meet a fundamental principle of health; it provides no way for the escape of impure, offensive, and injurious matters thrown off on the air from the lungs and skin. Besides these *serious* disadvantages, the stove, occupies considerable space *in* the room, with pipe sometimes running half the length of the house, in some churches passing over the preacher's head, very much to his discomfort,* and to a great extent disfiguring the room.

But stoves *must* be used, it seems, in most of our small churches and school-houses. Where this is the case, the only alternative is to provide well for counteracting the evils above suggested. Let the stoves be placed at no great distance from the doors, as they will be less in the way, and will distribute heat better from that point than any other. Put them from 4 ft. to 6 ft. from the wall, and let the pipe enter a well-constructed flue not far from the stove. The flue has better support at the wall than when resting on the upper joists. It should extend 6 ft. or 8 ft. above the roof, neatly finished outside, and smoothly pargeted inside. Get a good quality of stoves, use good fuel, keep a vessel of clean water on each stove, *be sure to ventilate the house thoroughly*, and there will arise no special difficulty from this manner of heating.

The fire-place and open grate have some advantages over the stove. The merits of the fire-place have long been held in high esteem. It is said that in England, during the reign of Queen Elizabeth, apologies were made to visitors if they could not be accommodated with rooms having fire-places; and to such an extent has it since been associated with domestic comfort and conviviality that the word *hearth* has come to mean as much as *home*. It is better adapted to residences than school-houses or churches, and is recommended specially for such use. It is *cheerful*, and affords pleasure to the family as they gather about it in winter evenings, with the most aged assigned to the corner—the post of honor—and each of the others in his accustomed place. It is *healthy*, because it necessarily furnishes some ventilation to the room it is intended to warm. This ventilation is produced by the creation of air-currents from every portion of the room to the fire-place, or grate, to be forced out through the chimney by heat. These currents are often strong enough and cold enough to affect unpleasantly the backs and feet of persons sitting at the fire; but they counteract this evil by bearing away the injurious products of combustion.

The flue, or chimney, need not be as large, and especially as unsightly, as it is frequently made. Strength is added to the draught by the increased *height* of the chimney; but there is no advantage in *size* increased beyond 9 or 12 in. square for an ordinary fire-place, or grate, the burning of coal requiring a larger flue than wood. The best draught is secured by locating the fire-place some distance from the doors, with the chimney built as nearly perpendicular as possible and smoothly plastered inside. Some means must be provided for bringing in fresh air in place of that which is being consumed or borne off by the fire.

* In a letter to the author on this subject, the Rev. Bishop Marvin remarks: "Let every body know that the stoves ought to be nearer to the doors than to the pulpit, and that it is a violation of all good sense to run the pipe over the preacher's head."

The hot air furnace is now generally used in the larger city and village churches. It is not free from objections; yet its merits, as a means of heating public buildings, are superior to those of the stove. The air, even fresh air from the outside, by coming in contact with the heated surface of the fire-chamber, loses much of its moisture, and is thrown into the room with a dry, sulphurous smell, which is both unpleasant and unhealthy. The dryness of the air is remedied in a large measure by evaporation from the water-pan on the furnace, which is required to be kept supplied with fresh, pure water. The sulphurous gas derived from the burning fuel is not easily removed. If all the joints in the furnace were put together so that they could not be opened by the expansion and contraction from heat and cold, even this would not retain in the heated air its original freshness and invigorating qualities. It is held by scientific men that these offensive, gaseous products of combustion cannot be controlled even within the cast-iron sides of an ordinary furnace. Their presence and effects must, therefore, be counteracted, as far as possible, by an efficient system of ventilation.

The wrought-iron furnace* is claimed to be superior to the cast-iron in the matter of furnishing pure air, for the reason that the joints can be secured closely and are not liable to be opened by heat. The prices of this heating apparatus are from $150 to $900. It is more expensive than the cast-iron furnace.

Hot water is a means of heating that gives more satisfaction to the occupants of a room than any other system. Steam is also good, but cannot be regulated in temperature as readily as water. In either case pipes are used to convey the water, or steam, to any part of the room desired. In a church these pipes may be arranged to run under and lengthwise of the pew. This puts a heating apparatus in every pew, so that the occupants are not only surrounded with warm air, but may keep their hands and feet warm from the pipes. On account of expense, however, but few churches can afford to use either of these methods. Another discouragement to their adoption is the danger attending the fire, and engines necessary to run them.

Supposing a hot-air furnace to have been adopted for warming a church, we would recommend: 1. That the furnace be of ample size, for, if it is small, it will become necessary to force it to its utmost capacity to produce the required heat (65°) for a given room, which will consume more fuel and the sooner wear out the furnace. 2. Get a furnace adapted to the fuel to be used. Wood requires a different construction from coal, and the two principle sorts of coal are suited with a furnace made specially for each. Eastern furnaces are made with reference to burning anthracite, or hard, coal, which is generally used in that part of the United States, and therefore their flues are too small and their metal too light for the bituminous, or soft, coal of the West. 3. The place, or location, of the furnace will have much to do with rendering it efficient. It should be near the smoke flue, to secure a strong draught. The hot-air pipes should be as nearly perpendicular as possible, to send the heated air directly upward into the room. The best point for the hot air to enter the audience-room of a church is, as already stated, toward the front—that is, less than half the distance from the door to the pulpit.

* One has been recently put in the Broadway Methodist Church, Louisville, Ky., by Mr. J. S. Lithgow, of that city, which, he says, gives more satisfaction than either of the two or three furnaces they had tried before.

Fig. 14, Des. No. 4, shows a good arrangement for heating with a furnace. The furnace is represented by *a*; *b* is the smoke-pipe, carried up through the flue to the top; *c*, *c*, are air-ducts extending from the ventilating registers in the floor to the flue; and when the air in the flue, being rarefied by the hot pipe, ascends, it forces the cold and vitiated air out of the room, while fresh hot air is supplied by the pipes *d*, *d*.

School-house Des. No. 3, Figs. 58 and 59, is heated and ventilated on the same plan.

Many small churches and school-houses must continue to be heated by stoves. Parsonage kitchens must be furnished with ranges. Those desiring to purchase, and having to look abroad to obtain what they need, are referred to the Eagle Foundry, Louisville, Ky., conducted by J. S. Lithgow, who is known far and wide as a reliable and generous man. The larger churches and school-houses will do well to adopt the hot-air furnace for heating. We have used and thoroughly tested for this purpose the furnace manufactured by A. Lotze & Sons, Cincinnati, Ohio, and do not know of any heater superior to it. It is extensively used, and may be had of agents in most of our cities. The Central Methodist Church, in Memphis, Tenn., built according to Des. No. 10, is well heated in the Sunday-school room and auditorium by two of these furnaces. The prices range from $75 to $300. The School-house Ventilating Stove, patented and manufactured by John Grossius, of Cincinnati, meets every demand as a school-house heater, whether the room be large or small. It supplies two great wants: ventilation, and a full supply of warm, fresh air; the former being necessary to secure an active mental condition, and the latter secures a healthy condition of the body, without either of which pupils make but little progress in their studies. It is convenient, economical, and durable, and is recommended by the fact that it is used in the public schools of Cincinnati and other large cities. The prices range from $40 to $100.

VENTILATION.

This subject, like that of heating, involves, to a very great extent, the comfort, health, and life of man. Because, however, its philosophy is not generally understood, and its effect not immediately and fully realized—that is, the effect not associated with the cause—we are accustomed to attach no great importance to it, and therefore spend but little money, effort, or thought, to provide for it. Pure, fresh air is in the highest degree conducive to health, happiness, and long life; and to provide plenty of such air in our houses, as nature has provided it elsewhere, is the object of ventilation.

The air we breathe, and on which life depends, consists of oxygen 1 part, nitrogen 4 parts, carbonic acid 1-1000 part, with a variable proportion of water. The principle in the air that sustains animal life is oxygen. In respiration most of the oxygen is taken up by the blood in the lungs, and carbonic acid gas given off in its place, or rather the small proportion of it is increased to about 4 per cent. Carbonic acid is pronounced by chemists "a deadly poison." Its effect, when breathed, is to retard, and finally stop, the circu-

lation of the blood. Thus, air that is reïnhaled produces languor, insensibility, and death. In an occupied room, where there is no ventilation, the whole body of air becomes vitiated in a very short time; for it is estimated that each individual will contaminate from 5 to 10 cubic feet of air per minute.

But not only is the air by use deprived of its vitalizing property, and made poisonous in itself, but it gathers from the blood and lungs all their putrescent excrement, and holds it to be returned again to the system in a few succeeding breaths. As the blood makes its entire circuit through the body in about 3 minutes, having the opportunity of throwing off its impurities by exposing itself to the air in the lungs upon a surface of nearly 400 ft., and as it is estimated that, on an average, each adult throws off nearly 1 oz. of decayed animal matter per hour through the skin alone by insensible perspiration, no wonder that the air in our unventilated churches, school-houses, and residences, becomes so impure, unpleasant, and unhealthy. Frequently a minister and his congregation go away from the house of God depressed physically, intellectually, and spiritually—half of them, perhaps, with a headache that unfits them for any sort of enjoyment—because they have been breathing for an hour the air expelled from each other's lungs, and burdened with whatever putrescence disease may have thrown off. The speaker has felt languid, and therefore delivered his message with less animation than he otherwise would have done; and if he had spoken most eloquently, his hearers were not in a condition to become interested in himself or his subject. A sermon may fall powerless, when the blame attaches to neither preacher nor people (although the preacher frequently has it to bear); for the circumstances, the foul state of the atmosphere, and its evil influences, are averse to speaking and hearing.

Referring to the subject of ventilation as affected by the presence of carbonic acid, Prof. Steele has well said that "the languor and sleepiness we feel in a crowded assembly are the natural effects of this narcotic poison. The idea of drinking in at every breath the exhalations that load the atmosphere of a crowded, promiscuous assembly is as disgusting as it is noxious. We shun impurity in every form; we dislike to wear the clothes of another, or to eat from the same dish; we shrink from contact with the filthy, and yet, sitting in the same room, inhale their poisonous breath. Health and cleanliness alike require that we should carefully ventilate all public buildings, our school-houses, and sleeping apartments. It is a fact, as poetical as it is characteristic, that when the air comes from the lungs it is poisonous, fully charged with the seeds of disease, so that if we should re-breathe it, death would inevitably ensue; yet as it passes out it produces all the tones of the human voice, all songs, and prayers, and social conversation. Thus the gross and deadly is by a divine simplicity made refined and spiritual, and caused to minister to our highest happiness and welfare."*

But its use here ends until, in due process of the divine economy, such chemical changes are wrought as will dissipate its injurious properties and restore its purity. By coming in contact with vegetable matter the foul air is relieved of its carbonic acid gas, and reinvested with pure oxygen: the former being necessary to vegetable life, and the latter to animal life. It follows that the air, in either case, as soon as once used, should

* Chemistry.

be removed. Full provision is made for this in nature, and we have only to follow what the laws of nature require—at least, not to contravene those laws in their operations.

The demands for ventilation in public buildings are more urgent at night than in the day, and in winter than in summer, for the combustion of lamps, stoves, etc., being similar to that which takes place in the human lungs, helps to exhaust the pure air of the room. In summer-time the doors and windows are thrown open, which serves to introduce *pure* air as well as *cool* air. This mode of ventilation is not without its objections, however, and cannot well be adopted at all times.

Another evil of unventilated houses is that, as internal combustion is hindered, a higher degree of temperature in the air is required to give a comfortable warmth to the body than when good ventilation is secured; and the body is so affected by such a state of things as to make its transition from this temperature to that of the out-door air in wintry weather productive of colds, which often induce severe disease.

The temperature of our bodies being higher than that of even the heated air around us, breathing has the effect of rarefying this air, and causing it to ascend when exhaled; but the carbonic acid gas, being heavier than the atmospheric air, descends to the floor as soon as it has given off its extra heat; and, except so far as, like other gases, it diffuses itself through the body of air in contact with it, the space near the floor remains infected with its poison.

Again: warm air introduced into a room goes immediately to the top, and there remains until equalized in temperature with the colder air below it, or it is forced down by this colder air being taken from the room. So cold air, entering any apartment, takes its place near the floor, pushing the warmer *strata* upward.

It follows from the foregoing considerations that, in cold weather at least, ventilation should be established near the floor rather than near the ceiling. It is better even in warm weather, for carbonic acid and the effete matter from the body will seek a place at the bottom of a summer air. If, however, a strong outward current can be established by an opening through the ceiling *to the outer air*—for a mere *opening in the ceiling* will amount to nothing—and a cold current can also be introduced at the ceiling, but not too near each other, the proper temperature and purity of the air may be very well maintained.

There are two objects to be aimed at in ventilation: the removal of foul air, and the introduction of that which is fresh and pure, and of that temperature that will conduce to comfort and health. One of the most effectual modes of accomplishing these objects, without producing objectionable and injurious currents of air, is to ventilate from the floor and ceiling also. The working of this plan is shown in Church Des. No. , and in Des. No. , for school-house. In one case the heating is by two hot-air furnaces placed in the first story, the hot air being introduced into the auditorium above through pipes and registers at the floor. There are also two ventilating, or cold-air, registers in the floor (aisles) of the auditorium, having each a wooden duct in the floor leading to a flue made for the purpose on each of the side-walls. These flues do not appear in the first story, but have a register at their foot in the lower ceiling, opening into the Sunday-school room. By this register either the upper or lower room can be ventilated as may be desired. The flues run out through the roof 8 ft. high, and have a cap over them to keep out rain. In

winter these flues take off the cold air at the floor, where it has been driven from the upper part of the room by the heated air, which, on entering the room, ascends to the ceiling. This process, continued, will in a short while exhaust that part of the air that is cold and foul, and supply its place with that which is warm and fresh. In Church Des. No. 7 this mode of ventilation has its efficiency increased by the smoke-pipe running up through the flue, the heat of which creates a draught and forces out the air. The ventilating flue may be separate from the heating apparatus, having attached to the pipe a small stove to create the draught, which can be used in summer or winter.

The openings in the ceiling just mentioned are intended mainly for summer, and can be best made by using the ventilating reflector. The heat from the lights creates a very strong current through the opening in the reflector into the roof of the house, where it must have a flue to continue it through to the outside. This process exhausts the warm air, causing that which is colder to flow in, and may be used with good effect night or day.

The following is a *simple and cheap plan* of ventilation, recommended in a prize essay read before the Massachusetts Medical Society:

"Fit into the window-frame, near the bottom of the window, a thin piece of board six or eight inches wide and long enough to reach from side to side of the frame. Push this piece of wood close up to the sash, but not so close as to prevent its proper up-and-down movement. Secure it in its place by a wedge, or in any other more substantial manner, so that it may be turned up and down as on a hinge next the sash. Generally the friction at the ends, if the board is light, will hold it in place; if it does not, a string fastened by one of its ends to the upper part of the lower sash, and the other to the edge of the board, will fix it in any desired position. If the opening is directed downward and the sash raised (never above the upper edge of the board), the entering air will go toward the floor. It is a fact, easily demonstrated, that air striking a surface does not rebound from it like an elastic body, but moves parallel to the surface and diffuses itself along it. Air entering in the manner here described soon reaches the floor and gradually displaces the air above it until it fills the room, and this without perceptible draught. If the same board be placed with its lower edge upon the window-sill, inside the sash and against the frame, leaving a space between the board and the sash, the entering current will have a movement directly upward; it will also enter between the sashes with the same direction.

"To the upper sash a similar board should in the same way be fitted, also movable, with the opening turned obliquely upward. Air entering at the top of the window then strikes the ceiling, along which it moves, is diffused, and all draughts avoided. This arrangement does not prevent the escape of air at the same place, if the current is in the opposite direction. 'Millinet,' or other open material, may be secured to either board or to the sash, to break the force of the current or to prevent the entrance of rain, insects, or dust. A piece of cloth fastened to the lower edge of the lower board will lead the entering air along the wall as directly to the floor as may be desired. Triangular pieces of pasteboard, nailed to the ends of the ventilating boards, will give the air a more definite

direction. If the windows have no outside blinds, a board, like that described, outside of the sash, directed downward, effectually excludes rain.

"By this method air can be made to sweep along the ceiling and along the floor, or in any other direction, without affecting unpleasantly the occupants of a room. The strength of the current is easily controlled by raising or lowering the sash.

"All can, in this way, enjoy the luxury of fresh air, without danger from sudden changes of temperature or sudden blasts of wind."

If carefully executed, this arrangement will not be objectionable in appearance.

But very large public buildings require an apparatus on a more extensive and expensive scale. The capitol at Washington is ventilated by means of large fans, driven by steam-engines aggregating 46 horse-power. This apparatus carries off the carbonated or vitiated air, and introduces that which is pure, at the rate of about 65,000 ft. per minute, consuming 6¼ lbs. coal in that time. But it has been estimated that the same ventilation can be accomplished by the heated shaft, or flue, at much less expense. Calculating upon the basis that 1 lb. of coal will heat 30,000 cubic ft. of air 10 degrees, and thereby create a current in the flue with a velocity of at least 5 ft. per second, it is ascertained that nearly two-thirds of the fuel can be saved, in addition to the expense of a competent engineer. There are, also, other advantages in the heated shaft over the fans.

It is not necessary to say more on this subject than to insist on a thorough ventilation by securing an incoming current of air, filtered from all adventitious impurities, and so divided that no draught can be felt; and an outgoing current, which shall carry out of reach the carbonic acid, carbonic oxide, sulphurous acid gas, and other noxious compounds so rapidly generated by the lungs, stoves, furnaces, etc. This precaution must be observed in our churches, in the school-houses which our children occupy so large a portion of the day, and in our homes, the family's constant abode. Without it, we cannot expect much comfort, pleasure, or good health.

ACOUSTICS; OR, ADAPTATION OF CHURCHES TO EASY SPEAKING AND EASY HEARING.

The principles involved in adapting an auditorium to easy speaking and easy hearing are nothing more nor less than the laws of Acoustics as taught in all our schools. Yet there are many and great failures in this respect in church-building, even from the designs, and under the supervision, of scientific architects. Indeed, perfect success is so seldom achieved that many persons have concluded, and not without reason, that it is a matter of accident, rather than the result of an intelligent combination of philosophic principles. It is not impossible, however, invariably to secure such acoustic properties to our churches as will make the speaking and hearing easy and pleasant. The main cause of failure is to

be found in the fact that our investigations of the subject are neither careful nor comprehensive enough. The question is frequently asked, "What dimensions, or proportions, of a room will give the best effect to sound?" as if no other items were to be considered than the general dimensions of the house; and as if observation did not teach that churches of the same general size differ in their sounding properties. A minister may preach in a church which has a recess behind the pulpit, and if any difficulty is experienced in speaking, the *recess* will be set down as the cause of it. In another case, the trouble may be attributed to the presence of a *gallery*. An *arched ceiling* may, in the same way, be brought into disrepute. And yet, when the recess was accused, it may have been that the platform alone, in reference to its height, was at fault. If the gallery affected the voice, it may have been not its presence, but peculiar construction. Where the arched ceiling was complained of, the cause of the trouble might have been the lack of ventilation, by which the delivery of the sermon was hindered. We have heard these things denounced; but that it *might* have been unjustly so will appear from the fact that Des. No. 10* has *recess*, *gallery*, and *arched ceiling*, and yet it is a *decided success* in acoustic qualities. It might have been a failure without them.

If certain proportions to a room could settle the question and always give the same results, we would merely refer to the figures mentioned on page 30; but we are concerned with much more than this. To get a correct and reliable theory—one that will bear out in practice—we must go back to the principles of natural philosophy, chemistry, and scientific architecture. We must consider the size, form, construction, materials, furniture, ventilation, heating, relative position of speaker and hearers, etc. Each of these things has its influence in determining the general effect.

No special emphasis is to be laid upon *form;* for almost any form of church can be made to serve the purpose well. If the proportion itself is not calculated to promote sound, such deficiency may be supplied by the introduction of other features. No defect, however, should be allowed, unless we are very sure that a complete remedy is at hand to offset its disadvantages. It is best to secure every possible advantage here, as the end to be accomplished is of the first importance.

One of the prominent points to be considered is the relative position of the speaker and his hearers. There is no position in which a speaker can deliver his discourse with more ease to himself and effect upon his hearers than when as near as possible to a level with them. The only argument for any elevation of the speaker is that he may see every face in his congregation and be seen himself. He cannot afford to dispense with either seeing or being seen; but when that point is attained, every inch of additional elevation above his audience is a disadvantage to both parties. The most natural and easy position for a speaker is standing erect, for by throwing the head and chest forward the free action of the organs of speech is interrupted, articulation becomes less distinct, or requires a greater effort; and a congregation is equally hindered in hearing—it requires greater effort to catch the words and follow the thought, and it is tiresome to keep the head, or even the eyes, for any length of time, raised above the level.

* Central Methodist Church, Memphis.

The above is a cogent reason against high platforms, as opposed to easy speaking and hearing.

Another in the same direction is that, according to the laws of sound, the voice is conveyed farthest and most distinctly along the level of its utterance; that is to say, when the medium of its conveyance is unchanged. It is a well-known principle in acoustics that sound is interrupted—diminished and changed—in its passage from one medium to another, especially to a denser one. There is a much greater difference between the density of the air at the ceiling of a church and at the floor than is generally supposed. It is sufficient to show a decided difference in the transmission of sound, the advantage being in favor of the denser air at the floor. But while the sounds of the voice, or the vibrations of the air, are transmitted readily through the medium first receiving them, and the more readily as the density of the medium is increased, yet are they deteriorated in intensity and the distance they can be heard is decreased—the rarer diffusing them and the denser retarding them—because communicated by a medium of different density from itself. Sound passes upward rather than downward, because the rarer atmosphere above is more easily impressed by the vibrations of the denser, in which the sound is generated. The velocity of sound is always the same, but its loudness or intensity decreases in proportion as the square of the distance increases, and is more dependent on the density of the air in which it is made than in which it is heard. A man speaking at the bottom of a well can be heard more easily at the top than one at the top can be heard below. Hence a whisper in the congregation can be heard more distinctly by the preacher in his elevated position than the same sound could be heard by the congregation if made by himself. Theaters and public halls are built with reference to this principle of acoustics; and therefore the choice seats, and indeed a majority of them all, are placed above the level of the speaker's platform. It would be well to observe the same rule in churches, unless, however, in case the volume of air emitted from the lungs of the speaker be excessively oxygenated (light and combustible), when it is generally preferable and more pleasant to the auditors to have the *explosion* above head, and directing its vibrations, or pulses, still upward. To make the *hearing* easy, therefore, the pulpit platform must be low.

But the character of the air inhaled has also much to do with the *speaking*—producing harmonious and pleasant sounds, or merely a harsh *noise*. Good articulation is promoted by using such air as is obtained in moderately low positions.

Ventilation is another element in the acoustic properties of a church. It affects both the generation and transmission of sound. The bodies first, and then the minds, of both the preacher and the people, are brought under the influence of vitiated air—more or less stupefied by its poisonous elements—and a complaint is at once set up that great difficulty is experienced in speaking and hearing. Such air is itself a bad conductor of sound. "Bad air, it is true, becomes much more dense, but the substances of this air are poisonous to the vitality of sound, as well as to health, mind, lungs, and voice; and this proves that sound can only carry out its function when well supplied with healthy and congenial air."* A

*"Acoustics and Ventilation," by Alexander Saeltzer.

good light also promotes sound, as it is a part of ventilation, and adds great elasticity to the air—not rarefaction, but the quality of readily receiving and transmitting sounds.

Sound is also, as we have said, influenced by the materials of which the walls and ceiling are constructed. Plaster with a rough surface is better than a smooth, hard finish; there is less reflection—less echo. Ceiling and walls finished with plank or paper are better in this respect than any kind of plaster. The voice, after making its direct impressions, is absorbed by these materials, instead of being thrown back upon the congregation to produce confusion. *Curtains* about the pulpit or windows, and *carpeting* on the floor, will affect favorably the acoustics of a church; but an excess of such soft surfaces will oppress the voice, and make the speaker experience a feeling of heaviness. The presence of a *congregation*—especially a large one—assists the voice. A *pipe organ* standing near the speaker will prove beneficial; it adds volume and melody to the voice. *Galleries* are frequently denounced as destructive of easy speaking and hearing; but if low and moderate in depth, and extending over a lobby or vestibule, they are an advantage rather than a disadvantage. Generally the hearing in the gallery is better than at half the distance from the speaker on the main floor. An end gallery is often introduced successfully to break up an echo. *Curved ceilings* are also a source of offense to some persons, who conceive that the only acoustic form is a flat ceiling making square corners with the wall; but it is asserted, in T. Roger Smith's treatise on "The Acoustics of Public Buildings," "that the plainest and simplest form of public room—namely, one rectangular in plan and in section, presenting, consequently, straight walls, a flat floor, and a flat ceiling, and having all the junctions of ceiling with walls, or walls with each other at right-angles—is of all others the form most liable to acoustic defects, and that in proportion as this type is improved upon the chances of success are increased." There is some advantage in low ceilings, but they may be arched without endangering the sound. Deep coffers are not the best, but heavy ribs will prove beneficial. The intersection of wall and ceiling should not be coved, but filled with a cornice of broken surface. This increases the apparent height of the ceiling. Splayed window-jams are better than those which set in straight. Irregularities on the wall or ceiling prevent reverberation. Des. No. 10, Fig. 38, shows a ceiling 22 ft. high at the walls, and 32 ft. at the highest point. Speaking and hearing are very easy, and much better than they would have been with a flat ceiling 22 ft. high. A very high, smooth, coved ceiling will generally prove to be what the Rev. Dr. C. K. Marshall calls a "sepulcher of the human voice." Such failures can hardly be remedied. The cheapest remedy, although only partial, is the sounding-board, placed horizontally a short distance above the head of the speaker. Another resort for bad acoustic properties is the stretching of wires lengthwise of the apartment, a few feet below the ceiling, which so affect the vibrations of the air as to improve the hearing and speaking. Application was once made at Washington by Mr. W. B. Carlock, of Bloomington, Ill., to patent this method; but we do not know that the patent has been granted.

Another remedy for defective acoustics, on account of high ceilings, is to stretch a covering of linen, or other material of this sort, a short distance below the ceiling. This lessens the space to be filled with sound, cuts the sound off from the ceiling, and prevents reverberation.

CARE OF A HOUSE.

MANY of our houses, private and public, very soon put on the appearance of age, and often prematurely decay, because of inattention on the part of those who occupy them. This will not occur where there is a faithful board of trustees, or a vigilant pastor in charge. The wood-work will be kept painted. The foundation will be protected from rain. Plastering will be renewed when it is *disfigured* or shattered. Shingles will be replaced as soon as they get loose. Glass will be put in when broken. The seats and floor will be kept free from oil, tallow, and sperm. The walls will be kept clean from spider-webs and dust. The house will be aired, but not at night or in wet weather, when the moisture in the atmosphere will stick dust to the walls and make them black. The gate and fence will be kept in good repair. The shrubbery will be preserved and cultivated. Every thing in the house and on the premises will be kept "decent and in order," and show that the occupants have some respect for the place and for themselves. Such attention is necessary to the durability and respectable appearance of any place. It costs little, but saves much. The trite saying well applies here: "A stitch in time saves nine."

FORM OF CONTRACT.

ARTICLES OF AGREEMENT made this —— day of ——, 18—, between *A*, *B*, and *C*, the Building Committee for the —— Church, of —— county, and State of ——, of the first part, and *X*, *Y*, *Z*, of the second part, of —— county, and State of ——.

The said party of the second part *does* hereby covenant and agree that, for the consideration hereinafter mentioned, *he* will begin immediately, and on or before the —— day of ——, 18—, have erected and completed, the new building for said Church, according to elevation, plan, and specifications of Des. No. ——, in the "Manual of Architecture," by W. M. Patterson. Said party of the second part is to furnish all the materials for said building of the best quality, and have all the work done in a neat, substantial, and workmanlike manner.

And the said parties of the first part do hereby covenant and agree that, in consideration of this covenant and agreement being strictly and fully kept and performed by the party of the second part, as specified, they will well and truly pay, or cause to be paid, to the said party of the second part, or *his* authorized representatives, the sum of —— dol-

lars; payment to be made when the work has been completed* according to this contract, and accepted by the party of the first part, free from all charges, claims, or liens, for material or work.

First. The specifications and drawings are intended to coöperate, so that any works exhibited in the drawings, and not mentioned in the specifications, *or vice versa*, are to be executed the same as if they were mentioned in the specifications and set forth in the drawings, to the true meaning and intention of the said drawings and specifications, without extra charge.

Second. The party of the second part is to furnish, at his own expense, all labor, scaffolding, implements, molds, and models, of every description, and all the hauling required in the due performance of this contract.

Third. Should the party of the first part, or their authorized agent, at any time during the progress of the said building, request any alteration, deviation, addition, or omission from the contract, they shall be at liberty to do so, and the same shall in no way affect or make void the contract; but in case of any difference in the expense, it is to be added to, or deducted from, the amount of the contract, at a fair and reasonable valuation mutually agreed upon.

Fourth. Should the party of the second part, at any time during the progress of the work, refuse or neglect to supply a sufficiency of materials or workmen, or in any way unnecessarily delay the work, the parties of the first part may, after five days' notice in writing being given, furnish any needed materials or workmen, or carry forward the work to completion, and the expenses therefor shall be deducted from the amount of the contract.

Fifth. Should any dispute arise respecting any part of the work or materials, it shall be referred to three competent persons: one selected by each party, and the third by those two; and the decision of a majority of these three shall be binding on all parties.

Sixth. The party of the second part shall take all necessary measures for the protection and good condition of the materials and work, and shall be responsible for any damage to the building during its progress.

IN WITNESS WHEREOF, the said parties to these presents have hereunto set their hands and seals the day and year above written.

....., (*Seal*).

....., (*Seal*).

....., (*Seal*).

....., (*Seal*).

* If the amount of the contract is to be divided into several payments, the time or stage of the work's progress at which each is to be made should here be mentioned; and in no case should any payment (except the last) be more than three-fourths the value of the amount of work done at the time it is made. This will secure the completion of the job.

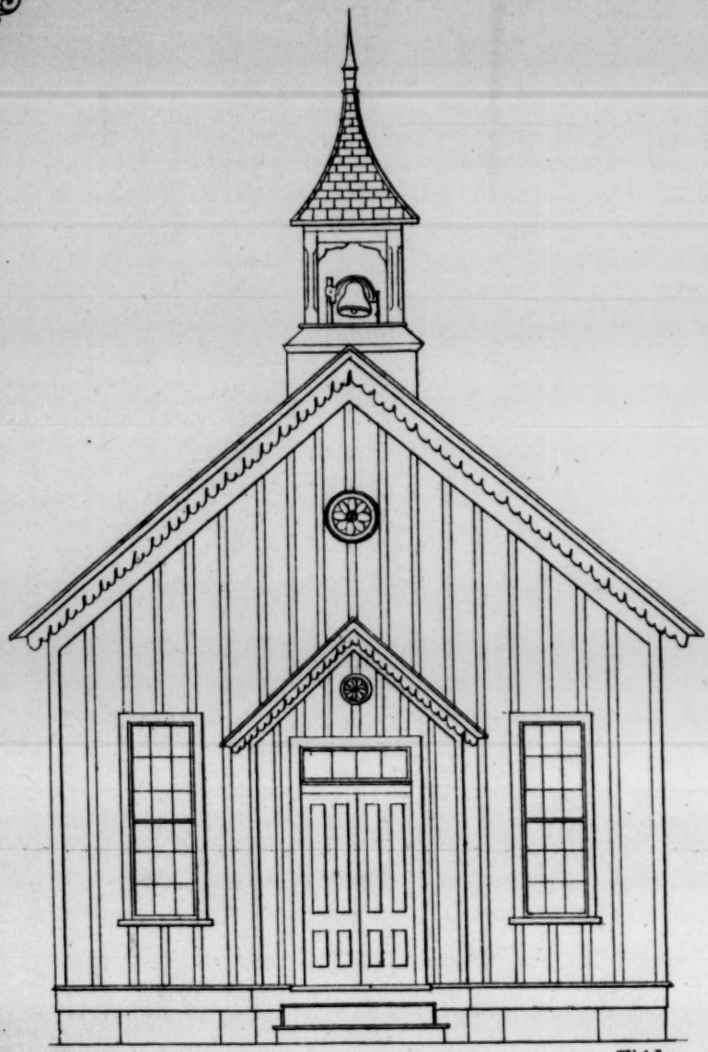
DESIGNS FOR CHURCHES.

In the following Designs the plates have not been made to any particular scale, for exactness in the scale would require much larger plates, and therefore more than double the cost of the book. All dimensions, however, are given in figures, so as to make the work perfectly plain to all.

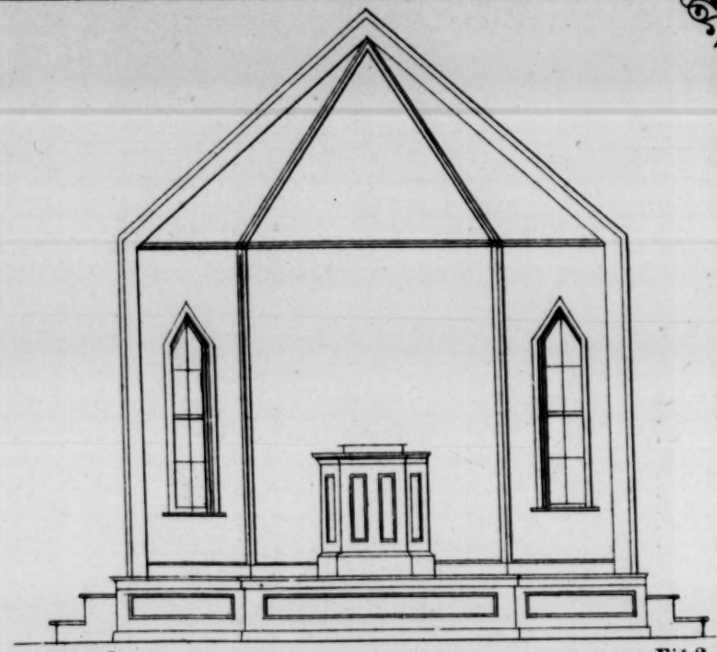
Any feature of these designs may be readily changed, it being necessary only to mention such change in the contract. One part of a design may be substituted by a corresponding part of another, as suggested in the "Preface" at the bottom of page 10.

The cost of buildings, as here given, is only approximate, as the prices of materials and work vary at different places and times, and from other considerations.

The form of contract here given is such as has been approved by the best of architects, with changes and additions to adapt it to this book. The confidence each party may have in the other is no reason for not entering into a formal written contract. If the work is divided between different contractors, a separate contract should be made with each party for his specific work. It is sometimes well to attach a forfeit for unnecessary delay in the completion of the work. It may be stipulated, for instance, that the contractor shall forfeit five, ten, or fifty dollars for each day after the time specified for the completion of the work till it is actually finished according to contract. Such a clause in the contract will stimulate to promptness in its execution. For unavoidable delay there should be no forfeit.



Des.1. Fig.1.



Des.3. Fig 3

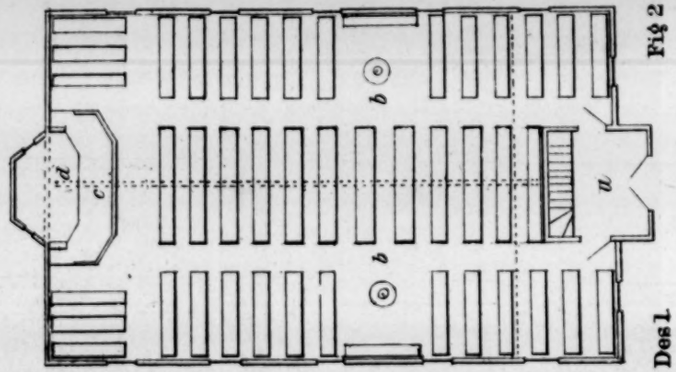


Fig 2 Des 1

DESIGN NO. 1.

TEMPORARY FRAME CHURCH, OR TABERNACLE.

Fig. 1 of Des. 1 represents a one-story frame house built for temporary use as a church, and may afterward be converted into a parsonage. Des. 2 for a parsonage (Fig. 42) is built from this church design. If the church is made with a view of being torn down afterward, and its place supplied with a permanent and larger structure, it may be built of upright plank, as shown in Fig. 1, with ceiling-joists the full height of the walls, and otherwise as required by specifications; but if a parsonage is subsequently to be made of it, weather-boarding must be used, as shown in Fig. 42, and according to accompanying specifications. It may, however, be built of rough upright plank, and afterward weather-boarded on the plank, the strips having been taken off. Other changes are to be made, as indicated in plans and specifications of Parsonage Des. 2.

This house is erected in new territory, for the accommodation of many who are not accustomed to church-going, and it must, therefore, be made comfortable and inviting, though not expensive; for more external inducement must be offered this class of persons than would probably suffice for those in the habit of attending upon the ordinances of God's house. These considerations suggest the general arrangement shown in Fig. 2. As this ground-plan is somewhat of a model for small churches, it is referred to in the specifications for other designs, also; hence the stairway and pulpit-recess appear. The vestibule, arrangement of seats, location of stoves, etc., are shown as they should be in this design. The bell is an important feature of a town or city church which is located in a new community, for many of the people intended to be benefited by it will need to be reminded, by the presence of the modest belfry and the solemn sounds going out from it, that the privileges and blessings of the sanctuary are brought near unto them, and they are invited to the public worship of God.

This design may be executed complete in any community for $1,000. In many places it can be done for less, and yet be neat and substantial, wearing a church-like appearance, and being comfortable and pleasant to all who may gather within its sacred walls.

SPECIFICATIONS OF MATERIALS AND WORK FOR CHURCH DESIGN NO. 1.

Dimensions.—The *audience-room* is 27 ft. by 45 ft. inside, with ceiling 14 ft. high in the clear. The *ground-plan* is shown in Fig. 2, except that the pulpit-recess and stairway are omitted in this Design. The *vestibule* (*a*) is 9 ft. square inside, projecting 4 ft. outside of the front wall.

Foundation.—The *outlines of the foundation* are established by taking an ordinary piece of twine, or small cord, and staking it on the intended line of the front of the build-

ing, the outside width of the house being marked on that line. The sides of the building are marked by another cord drawn at right-angles to this, crossing at the points marked for the corners. The corners are made perfectly square by measuring on the front line 8 ft. from the corner, then on the side line, 6 ft. from the same point, take 10 ft. as the hypothenuse (stretching between the two points last marked), and a perfect right-angle will be formed at the corner. Repeat the process at each corner. Mark the places for the piers, and let the cord remain till the foundation is laid.

Brick-work.—Build *piers* of hard-burned brick and good lime-and-sand mortar; 9 in. by 21 in., with 6 in. footing (projections at base); beginning 18 in. below the surface of the ground, and running 18 in. above; placed in front, as shown by Fig. 1, at the sides a pier under each space between the windows, two under the middle sill, and one at the middle of the rear sill. The corner piers of the main building and vestibule are returned, and those at the intersection of the front sill with the sills of the vestibule, and the rear sill with the middle sill, are made like a T. The earth dug up for the piers is to be thrown up around the footings so as to run off the water and protect the piers.

The *smoke-flues*, one on each side, are built at the wall, beginning 4 ft. below the ceiling, and running 5 ft. above the roof, made 18 in. square outside, with a cap over the top.

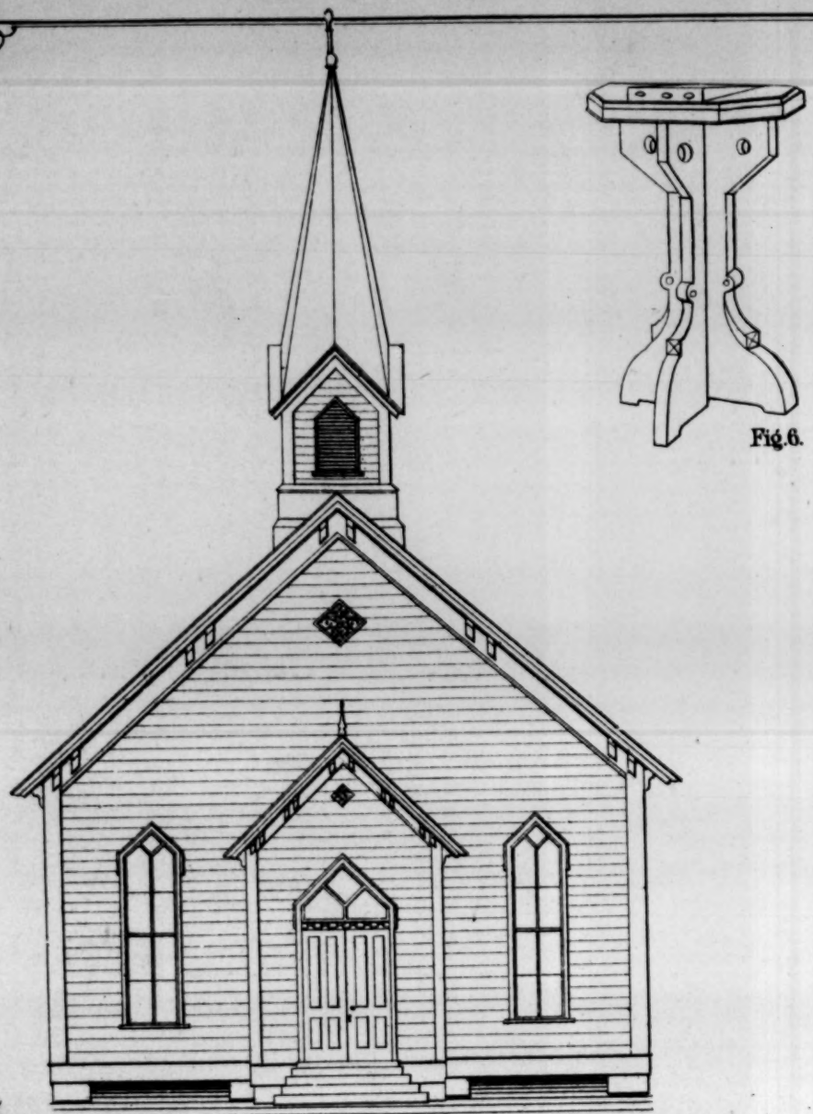
Framing Timbers.—The *sills* are 6 in. by 10 in., the side and rear sills are in two pieces each, with 12 in. lap on the middle pier, two 1½ in. wooden pins fastening each lap. The sills at the corners are halved into each other and fastened with two 1 in. pins. The front and middle sills tenoned into vestibule sills and securely pinned.

The *joists* are 2 in. by 12 in., 2 ft. from centers, cross-bridged between outer and middle sills, let into the sills flush and well spiked at each end.

The *studs* are 2 in. by 4 in., set in on the sill 1 in. *Corner posts* 4 in. by 4 in., tenoned into sills and plates. *Door* and *window posts* 4 in. by 4 in. *Braces* at top and bottom of corner posts 4 in. by 4 in., 5 ft. long, well spiked.

Plates 4 in. by 5 in., made of two pieces 2 in. by 6 in., spiked down on the studs. *Rafters* 2 in. by 5 in., spiked together on a ridge-board at the top and to the plate and joist at the foot. *Ceiling joists* 2 in. by 6 in., full length, 2 ft. from centers, spiked to foot of rafter and plate, and supported by an 8 in. plank, one end nailed securely to the joist, and at the other to the top of the rafters, the middle of this plank being also nailed to the collar-beam. *Collar-beams* 2 in. by 4 in., 14 ft. long, spiked to the rafters. *Corner-posts* of belfry 6 in. by 6 in., tenoned and spiked into the plate of the vestibule, securely braced with 2 in. by 4 in. stuff and plate 4 in. by 6 in.

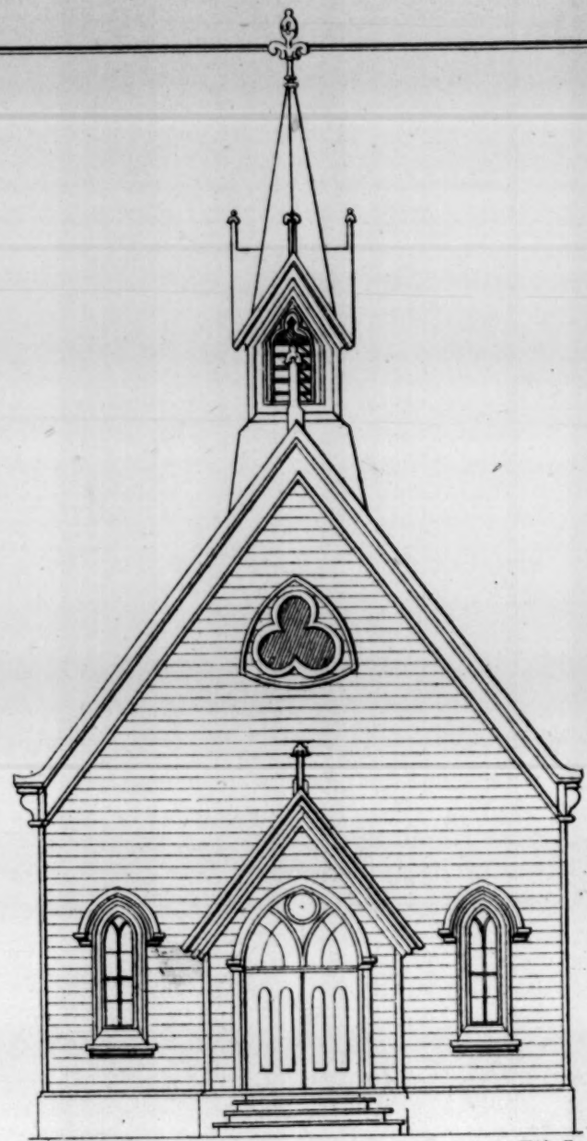
Outside Finish.—The walls are covered with 1 in. *boards*, 12 in. wide, placed vertically, nailed with 10-penny nails to sills, plates, and a horizontal tie 1 in. by 6 in. nailed to the outer edge of studs half-way up the walls. The joints of the siding are covered with *battens* 1 in. by 3 in. *Base* 10 in. by 1 in., dropped 2 in. below the sills, surmounted by water-table 2 in. by 2½ in., which, being nailed to the sill, receives the lower end of the siding. *Battens* on the main corners 6 in. wide; of vestibule 5 in. *Joists* and rafters of vestibule 2 in. by 4 in. Ceiling of vestibule 10 ft. high. *Cornice* projection 18 in.; *facia*, 14 in.; *scroll-work*, 6 in.; *crown-mold*, 5 in. *Sheeting* 1 in. by 6 in., 6 in. apart, shingles 18 in., with 6 in. to the weather.



Des.2.

Fig.4.

Fig.6.



Des.3.

Fig.5.

Sherbridge & Co Lith. Co.

DOORS.—The *door-frames*, of 1¾ in. plank; doors paneled, the front double, and 4½ ft. wide by 7 ft. high, with 18 in. *transom*. *Inside doors*, 3 ft. by 7 ft. All doors 1½ in. thick, cased as windows.

WINDOWS.—The *window-frames* of 1 in. stuff for styles, outside casing 1½ in. by 4 in., inside casing 1 in. by 6 in., with 2¾ in. band molding, the *frame* making a *box* with the stud. *Sash* 1½ in. thick, 18 *lights* 10 in. by 16 in., hung with pulleys and weights. Windows set 2 ft. from the floor.

INSIDE BASE 10 in. wide and 1 in. thick, beaded at upper edge, with ¼ round at the floor.

FLOORING of yellow pine boards 1 in. thick, dressed, tongued and grooved, and put down closely with 8-penny nails.

LATHING AND PLASTERING.—Good laths put on regularly, and two-coat work of plastering.

PAINTING.—The house will have two coats of paint. For outside, use recipe No. 5, page 52, and for inside, No. 11, page 53.

FINALLY.—All the above work will be done in a good and workman-like manner, and the materials for the same to be of the class specified.

DESIGN NO. 2.

SUBURBAN, VILLAGE, OR COUNTRY CHURCH.

THIS DES., Fig. 4, in most of its features, has been furnished for the building of several churches, and has invariably given great satisfaction. Its size can be changed to meet the wants of any locality. It is plain, but handsome and convenient. Fig. 2 is the ground-plan, and Fig. 3 represents the arrangement of the recess, platform, and pulpit. In Fig. 7 is shown the construction. The gallery can be built or left out, as may be desired. Its construction and finish are clearly shown in Fig. 7, and the stairway appears in Fig. 2. This house can be built for $2,500.

SPECIFICATIONS OF MATERIALS AND WORK FOR FRAME CHURCH, DESIGN NO. 2.

DIMENSIONS.—The inside measurement of the *audience-room* is 30 ft. by 50 ft., ceiling 16 ft. high. The *vestibule* (*a*) is 10 ft. square inside, ceiling 12 ft. high, with opening to the belfry 2½ ft. square.

BRICK-WORK.—The *piers* are of well-burned brick, put up with good lime-and-sand mortar, 9 in. by 27 in. and 9 in. footings (projections at base), 18 in. under ground, and 24 in above; a pier under each space between the windows; piers under middle sill 9 in. by 18 in., 9 in. footings, spaced as under side-sills, corner piers returned. The earth dug out for the piers is thrown back on their base when done, to protect their footing from water. Two *smoke-flues*, one at each place shown by the stoves in Fig. 2, built against the wall,

commencing 4 ft. below the ceiling and running 6 ft. above the roof, being 18 in. square, with a cap over the top. Inside of flues to be smoothly pargetted, the pipe entering about 1 ft. from the bottom of the flue. Outside made smooth and left clean.

FRAMING-TIMBERS.—*Sills* 8 in. by 10 in., butting laps 14 in., fastened with one two-inch pin each and spiked, halved together at corners. *Corner-posts* 6 in. by 6 in., tenoned at top and bottom. *Door and window-posts* 4 in. by 6 in. *Studs* 2 in. by 6 in., 16 in. from centers, spiked to plate and sill. *Braces* 4 in. by 4 in., 6 ft. long, at top and bottom of corner-posts, let into studs 4 in., and well spiked. *Joists* of first floor 2 in. by 12 in., in two lengths, 2 ft. from centers, jogged into sills flush and spiked, to make a tie across the house. One course of *cross-bridging* to each tier of joists. *Ceiling-joists* 2 in. by 8 in., 2 ft. from centers, let down 1 in. on the plate and spiked to plate and rafter. They are supported, as shown in Fig. 7, by *king-post* 2 in. by 6 in. spiked to rafters at top and to joists at the bottom (where the joists butt together), and by other *braces* 1 in. by 6 in., nailed to joists and rafters, as shown in drawings. *Rafters* 2 in. by 6 in., 2 ft. from centers, butting and spiked together at top, let down on plate 2 in., projecting 18 in. and spiked to plates and joists. *Plates* 4 in. by 6 in., made of two pieces 2 in. by 6 in. spiked together, the first piece being spiked down on the studs and the other spiked on that. *Corner-posts of spire* 6 in. by 6 in., first section tenoned into plate of vestibule, the plate of this section 4 in. by 6 in., making a square of 6 ft. at the top, and braced, as shown, with planks 1 in. by 6 in. The second section, or *belfry*, has corner-posts 6 in. by 6 in., tenoned at the foot into cross-supports 6 in. by 6 in., jogged on to the plate of the first section 1 in., and bolted with 1 in. iron-bolts, as shown. The plate of this section is 4 in. by 6 in. Corner-pieces of the spire 4 in. by 4 in., spiked to the plate and bolted to the post below with jointed bolts, as shown in plan. At the top of spire the timbers are brought to a point and securely nailed together. The studs, rafters, look-outs, etc., of the spire are 2 in. by 4 in.

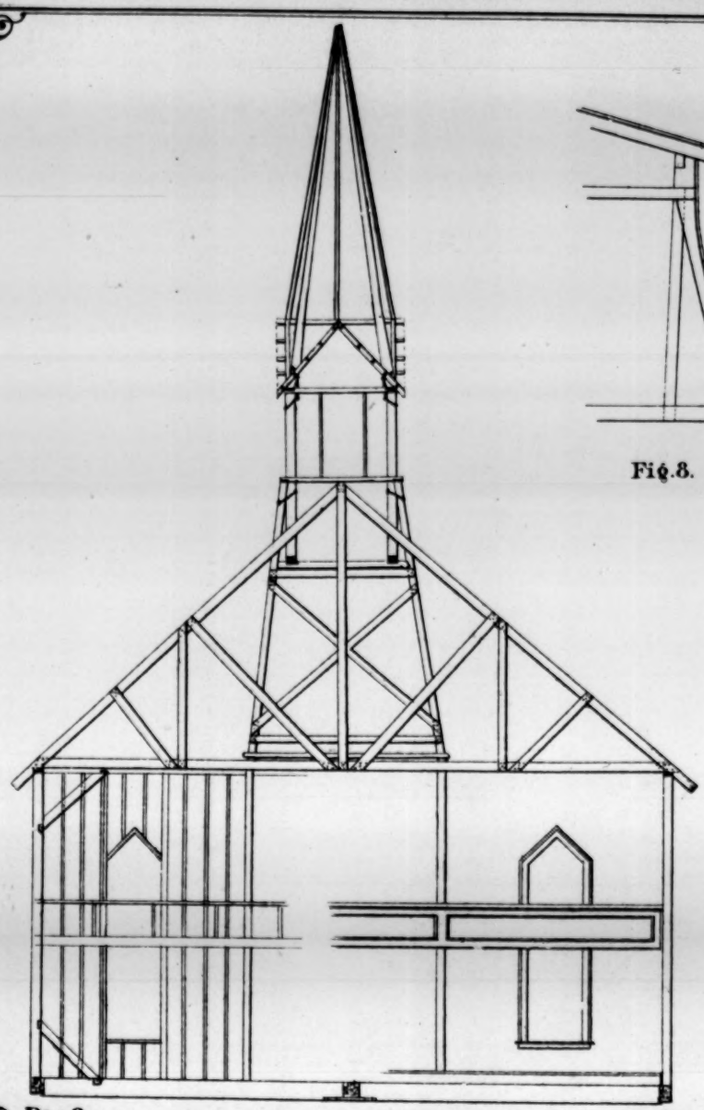
OUTSIDE FINISH.—*Base-course* 1 in. by 12 in., dressed, lower edge dropped 1 in. below the sill. *Water-table* 2 in. by 2 in. *Weather-boarding* 6 in. wide, dressed, showing 4½ in. to the weather. *Corner-boards* 10 in. wide, showing the same front and side. *Frieze* 14 in. wide. *Projection of roof*, front and sides, 18 in., lined with beaded ceiling. *Crown-molding* 5 in. wide. *Belfry* finished, as shown in plan (Fig. 4). *Brackets* 9 in. by 14 in., 3 in. thick. *Vestibule-finish* is ⅔ the dimensions of the finish of the body of the house. *Door and window-casing* 1½ in. by 4 in.

ROOF.—The roof is covered with *boards* 1 in. thick, 6 in. wide, 6 in. apart. *Shingles* 18 in. long, showing 6 in., and made of white-pine or heart-cypress. *The spire* is covered in the same manner.

DOORS.—*Front door* 5 ft. by 7 ft., with transom 3 ft. high to highest point, double shutters 2 in. thick, mortise lock, 5 in. butts. *Inside doors* 3 ft. by 7 ft., single shutter, paneled, good locks, 4 in. butts.

WINDOWS.—Four to the side and two in front are 3 ft. by 10 ft. in the clear, 2 ft. from the floor, with sash 1½ in. thick, as shown in drawings. The two windows in pulpit-recess are 18 in. from the floor of the platform, 2 ft. wide by 6 ft. high, the sash same shape as in other windows. Window-frames made box, and sash hung with weights.

INSIDE FINISH.—*Flooring* of yellow-pine, 1 in. thick, not over 5 in. wide, tongued and



Des.2.

Fig.7.

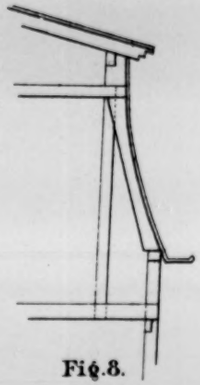


Fig.8.

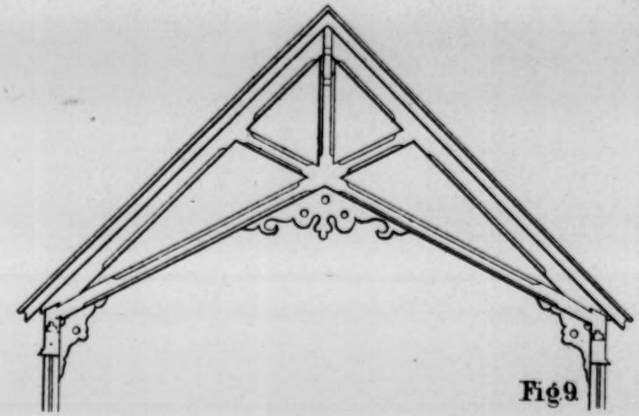


Fig.9.

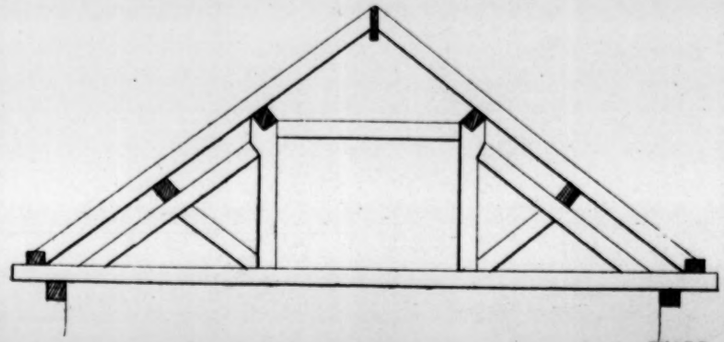


Fig.10.

grooved, laid close and smooth, secret nailed. *Base-board* 1 in. by 10 in., beaded at top edge with ¼ round at the floor. *Door and window-casing* 6 in. wide, with *band-molding* 1 in. by 3 in. Corner of vestibule inside of audience-room is protected by an upright wooden strip ¾ in. thick and 3 in. wide, to which the plastering is finished.

PULPIT RECESS.—The recess is 3½ ft. deep from inside of main wall, front opening 10 ft. wide, and 13 ft. to the highest point from main floor. *Facing of recess* 9 in. wide, 4 in. molding. *Angles* of recess filled with wooden molding 1 in. by 4 in. *Base-board* 6 in. wide. *Platform* 20 in. high, finished, as shown in Figs. 2 and 3. Floor within the altar raised 6 in. above main floor. Distance between altar and pulpit in front 5 ft. *Altar* 14 in. high, base 4 in. by 6 in., of walnut. *Balusters* 2 in. by 8 in. long, of yellow-pine. *Rail* 2 in. by 6 in., of walnut.

PLASTERING.—*Laths* to be of good quality, well dried out, and regularly put on. The plastering to be regular three-coat work, straight and smooth, the third coat being white hard-finish, left free from streaks or stains.

PAINTING.—Outside, the body of the house is painted light fawn color, and the trimmings white. Inside casings painted white, care being taken not to touch paint to the plastering. The platform and altar are varnished, showing natural color of walnut and pine. All windows are glazed with plain glass of good quality, and sash painted white. All to be three-coat work.

DESIGN NO. 3.

FRAME CHURCH FOR VILLAGE OR CITY SUBURBS.

THE arrangement and construction of this Design are the same as in No. 2. In style of architecture it presents more of the Gothic, and has a finer finish. The glass may be stained, which can be done for about $100 extra. The roof is made "open," as shown in Fig. 9, with a pitch of 16 ft., or something more than one-half. The roof-timbers are 4 in. by 10 in., constructed on the plan of the truss, or principal rafter, with purlins between, 2 in. by 5 in.; the sheathing of 1 in. narrow plank, dressed and varnished on the lower side. Other points in which this Design differs from No. 2 are shown in the elevation, Fig. 5. The church can be completed in this style for $3,000.

DESIGN NO. 4.

BRICK CHURCH, WITH SUNDAY-SCHOOL AND OTHER ROOMS.

THIS Design is different from the usual order of things. Complaint is often made against two-story churches, because of the difficulty in old persons ascending the stairs to the audience-room. This difficulty is here obviated, and still a separate Sunday-school room is provided. The front part of the building (*bb*) is one story, while the rear part, or ell, is two stories high. The Sunday-school room is on the second floor, fronting the side street, while the entrance to the audience-room is on the main street. By this arrangement, the younger people, instead of the older, ascend the stairs. Under the Sunday-school room is a class-room (*f*), entered from the hall at the side, and also from the audience-room. A convenient and pleasant office for the pastor (*h*) is provided, opening into the side-hall, and having a closet (*e*) under the stairway. Heating and ventilating operations are carried on successfully with a furnace in the cellar. This is an elegant building in every respect. It can be built complete for $10,000.

SPECIFICATIONS FOR DESIGN NO. 4.

DIMENSIONS.—The *vestibule* (*a*) is 10 ft. by 10 ft. inside, ceiling 10 ft. high; *auditorium* (*bb*) 40 ft. by 65 ft. inside, ceiling 20 ft. high at the walls; *lecture-room* (*f*) 23 ft. by 28 ft. inside, ceiling 9 ft.; *pastor's study* (*h*) 14 ft. by 16 ft., ceiling 9 ft.; *hall* (*g*) 6 ft. 3 in. by 19 ft. 3 in.; *Sunday-school room* 23 ft. 4 in. by 48 ft. 9 in., ceiling 13 ft. at the walls; *furnace-room* 20 ft. by 30 ft., 9 ft. to the first joists.

BRICK WORK.—*Walls* of *furnace-room* 4½ in. to top of ground, then 9 in. to first joists; walls of *tower* 22 in. thick, with 13 in. footings; walls of *auditorium* 18 in., with 13 in. footings; outside walls of *lecture-room* and *pastor's study* 18 in., 13 in. footings; wall next to audience-room 13 in., with 9 in. footings; other *partition* walls 9 in., with 4½ in. footings; walls of *Sunday-school room* 13 in., the offset being inside, and the walls running 3 ft. higher than main walls. All *foundation-walls* begin 2 ft. below the surface of the earth and extend 2 ft. above to first joists; a *cast-iron ventilator* 12 in. by 36 in. inserted under each window 10 in. from the ground. The wall at *e* and *f* in Fig. 14 runs down to the floor of furnace-room, as at *f* are the steps and door, and at *e* the opening for fuel, each covered with trap-door outside, as shown at *j k* in Fig. 12. *Buttresses* are 18 in. by 22 in., with three offsets at termination, covered with stone (or iron) caps. No salmon brick allowed in foundation-walls or exposed to the weather. All walls to be built true, and the outside to be left smooth and clean. *Front walls* to show brick of uniform color.

CARPENTER'S WORK.—*Joists* for first floor of auditorium 2 in. by 14 in., 16 in. from centers, in three tiers, supported by 9 in. dwarf walls, except over the furnace-room; then by a girder 10 in. by 14 in., into which the joists are let in flush, the girder being supported at the ends by brick walls, and in the middle by a 13 in. brick pier. Each tier of joists has two courses of *cross-bridging*. *Lecture-room* joists 2 in. by 12 in., 16 in. from

Des.4.

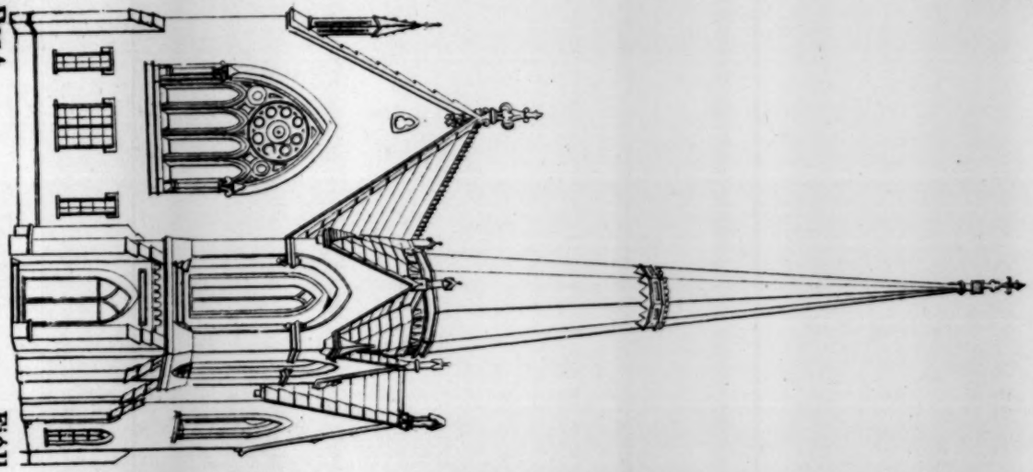


Fig.11. Des.4.

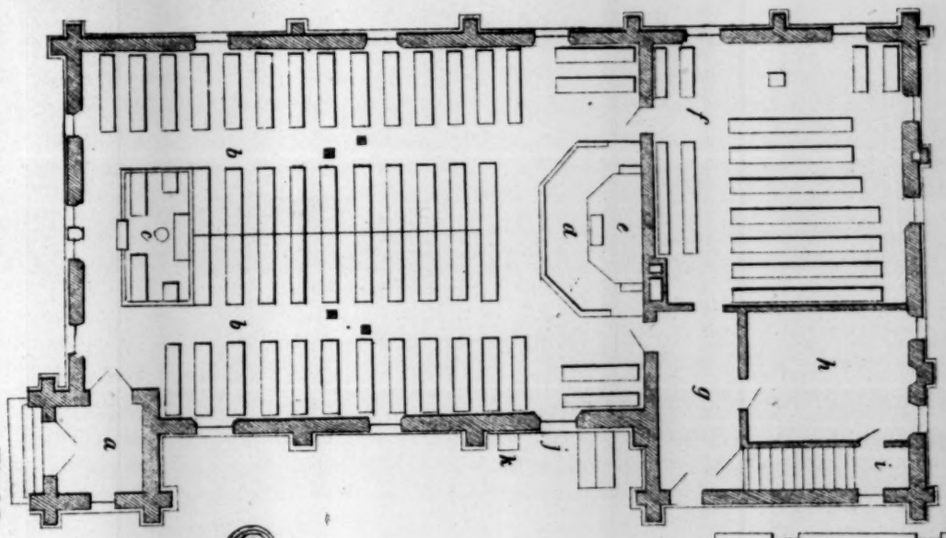


Fig.12.

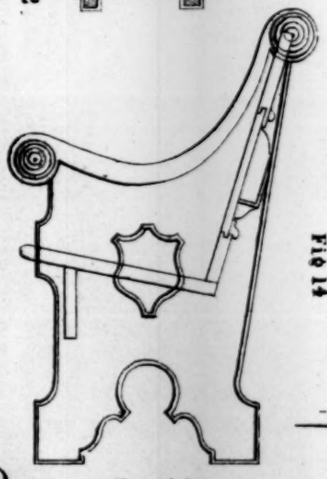


Fig.14 ½.

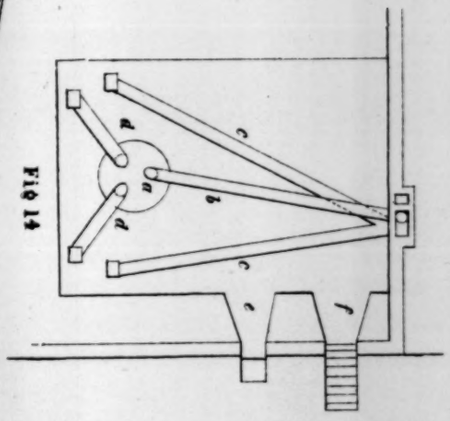


Fig.14

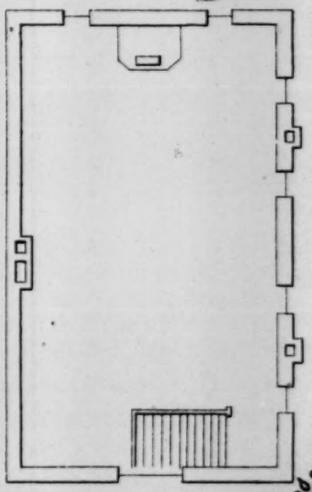


Fig.13.

centers, two tiers, with one course of bridging to each tier. Joists for *study* 2 in. by 12 in., 2 ft. apart, one course bridging. Joists for *hall* 2 in. by 8 in., 2 ft. apart, placed across the hall. Joists for floor of *Sunday-school room* 2½ in. by 14 in., 16 in. from centers and three courses bridging over the lecture-room, and 1½ in. by 14 in. over the study and hall, 16 in. from centers, one course bridging, and all anchored into the walls at both ends.

Doors.—*Front door* 5 ft. by 7 ft., 2 in. thick, made folding; four panels to each shutter, raised molding, mortise locks, 4½ in. by 4½ butts; Gothic *transom*, as shown in Fig. 11. *Outside folding-doors* to hall 4 ft. by 7 ft., 1½ in. thick, and all inside doors 3 ft. by 7 ft., with 18 in. transom; jams 1¾ in. thick, rabbeted for the door. All inside doors hung on loose-jointed butts, and furnished with good lock and key. The *inside casings* are 6 in. wide, band-mold 3 in. wide.

Windows.—*Windows* in side walls of *audience-room* 3 ft. 6 in. by 11 ft. to spring-lines of Gothic heads, 2 ft. from the floor, with box frames; sash hung on pulleys. *Front Gothic window* 8 ft. wide by 10 ft. to top of arch, and 10 ft. from the floor; frame made as shown in plan. *Lower windows* in front square heads, 2 ft. by 6 ft., 2¼ ft. from the floor. *Glass* for *audience-room* all to be stained. Windows in *second story* of *tower* are filled with lattice-work, this room being the belfry. Windows in *lecture-room* and *study* 3 ft. by 6 ft., square heads, 2 ft. from the floor. Windows of *Sunday-school room* 3 ft. by 5 ft. to spring, except one by stairway, which is 5 ft. by 5 ft. to spring-line of Gothic arch. *Inside casing* 6 in., with 3 in. molding.

Roof.—The *roof of audience-room* is constructed as shown in Fig. 36 of Des. No. 10, the specifications of which see. The pitch of the roof is 20 ft. The roof of the Sunday-school room is made after that of Des. No. 5, Fig. 19. The comb of this roof finishes same height as audience-room.

Plastering.—All the rooms (except for furnace) have three-coat plastering, the third coat being hard sand finish, the material of the best quality, and work of the best class, the walls being even and smooth, and free from streaks or stains. The ornamental plastering is done as shown in Fig. 38, or may be modified, or even left off altogether.

Inside Finish.—The inside finish and furniture of the audience-room is of solid walnut, and in the other rooms oak graining. All *casings* are 6 in., with 3 in. band-molding. *Base* 1 in. by 8 in., with 4 in. molding. *Flooring* is narrow, well-seasoned, free from knots, and laid closely with 8-penny nails. The style of finish for *platform* may be selected from any Des. given.

Painting.—All the *wood-work*, inside and outside, receives three-coat work of best white lead and oil paint, of such colors as may be directed. The *walnut-finish* has one coat of oil and two coats of best varnish. The *oak graining* is finished up with a coat of varnish.

Furnace-room.—The *walls*, etc., have already been described. The *furnace* (*a*), one of Lotz's largest size, is set level and solid under the center of the auditorium, so that the hot-air pipes may be as short and as near perpendicular as is required for successful operation. The *smoke-pipe* (*b*) is continued up the flue in order to force ventilation, the *wooden ducts* (*cc*) for ventilation, 10 in. square, being also connected with the wall-flue, said *flue* being 9 in. by 18 in. The *cast-iron gratings* are shown in Figs. 12 and 14. The other rooms are heated as shown by the flues.

DESIGN NO. 5.

A TWO-STORY CHURCH, FRAME OR BRICK.

For beauty, convenience, and cheapness, this Design can scarcely be excelled. It contains auditorium, Sunday-school room, class-room, and pastor's study. The dimensions can be increased to any extent desired. The specifications contemplate a frame house, but brick may be used as well, the walls being made 18 in. thick for first story, 13 in. thick for second story, and 9 in. thick for partitions. The outer walls of the tower should be 22 in., 18 in., 13 in., and 13 in. for the respective sections, the inside wall being 18 in. for first and second sections, and 13 in. for third and fourth. The timbers of the spire are secured to heavy cross pieces just below the top of the third section, this frame work to set in the wall 6 in. Pilasters 13 in. thick by 18 in. out. Walls and pilasters make the offset on the outside at the termination of the first story.

This building has been erected in wood complete for $5,000. Brick will cost one-third more.

SPECIFICATIONS FOR REMODELING AN OLD CHURCH.

Fig. 15 shows the front elevation of a city frame church, which has been built thirty years. Its surroundings are in advance of it, and the congregation worshiping in it desire a better building on the same lot. The *timbers* are still sound, and the *frame* intact; so the desired improvement can be made without tearing down the old house. The *plastering* needs to be renewed, but the *weather-boarding* can remain. The *shingles* have recently been put on, and need not be disturbed. The *ceiling* may remain flat, instead of being changed to correspond with Fig. 19. The old building can therefore be readily adapted to this Design. The wooden frame is to be raised from its piers high enough to allow the construction of a *basement* 9 ft. in the clear, divided into rooms, as shown in Fig. 17. The *basement walls* are to be 13 in. thick with 9 in. footings, furred out 1 in. on the inside for plastering, and 1 in. on outside for weather-boarding; *partition walls* 9 in. *Basement windows* to have square heads and plain glass, and the *old ones* changed to Gothic heads with stained glass. The *pulpit-recess* is added according to the specifications which follow these: this virtually lengthens the house nearly the depth of the recess. The *vestibules* and *tower* are added, as shown in plans and described in specifications. *Tower walls* are 18 in. thick for first section, with 9 in. footings, the number of sections being reduced from four to three.

The completion of the building, according to these suggestions, can be accomplished at a cost not exceeding $2,500.

SPECIFICATIONS FOR FRAME CHURCH, DESIGN NO. 5.

Dimensions.—First section of *tower* 12 ft. by 12 ft. in the clear; *vestibule* on each side of tower 6 ft. by 7½ ft. inside; *Sunday-school room* 36 ft. by 43 ft.; *class-room* 14 ft. 6 in. by 23 ft. 6 in.; *pastor's study* 12 ft. by 14 ft. 6 in.; all the first story (Fig. 17) being 10 ft.

Fig 15

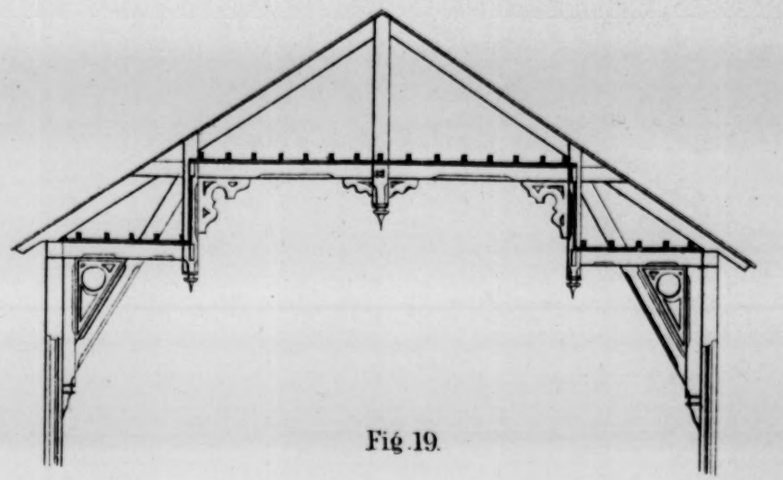


Fig. 19.

Fig. 20

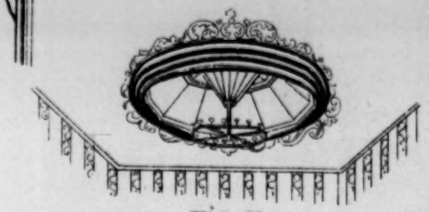


Fig. 21

Des 5.

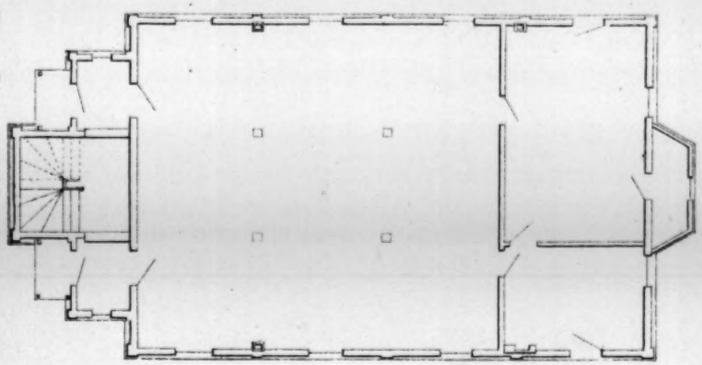


Fig 17.

Des 5.

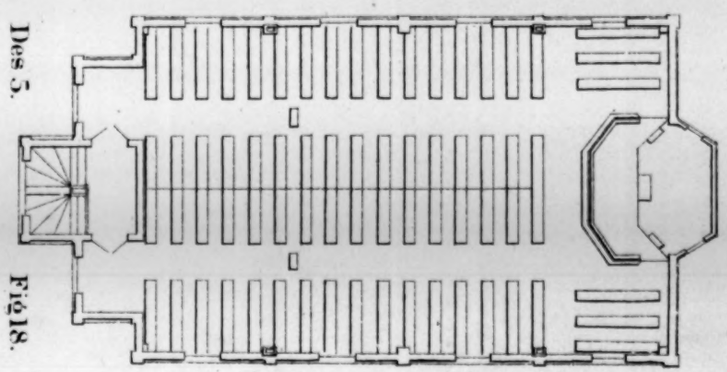


Fig 18.

Strobridge & Co Lith. Cin

high in the clear. The *audience-room* (Fig. 18) is 36 ft. by 58 ft. inside; *ceiling* at the wal 16 ft. high, in the center 19 ft. The ceilings of second section of the tower, and the open vestibules, or recesses, on each side of it, are made 2 ft. above the tops of the front windows. The *pulpit-recess* is 12 ft. wide, 5 ft. deep, and 16 ft. to highest point inside, the outer walls being 12 ft. high. This recess in first story is same width and depth as in second story, and will serve as library, closet, or coal-room.

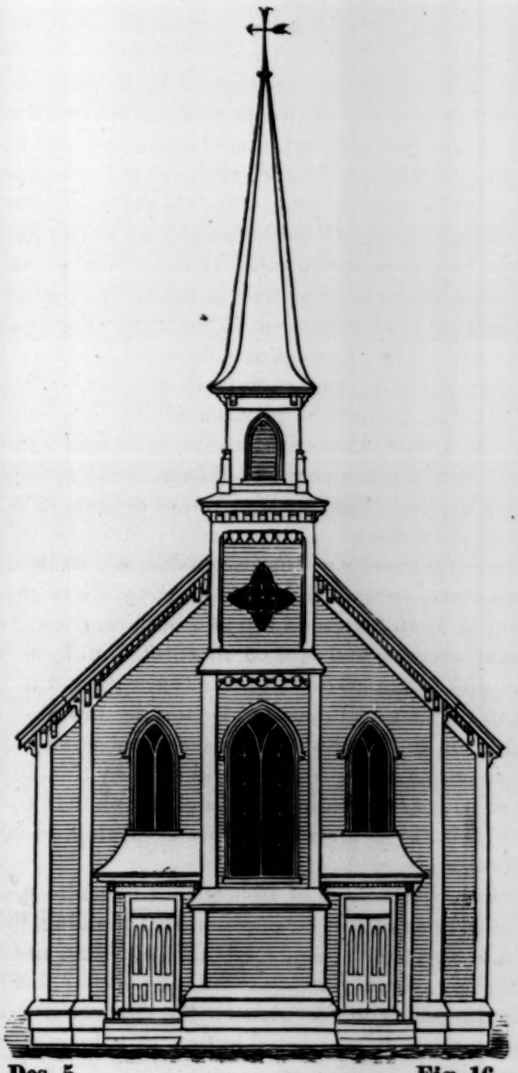
FOUNDATION.—The foundation is of well-burned brick, laid in good lime-and-sand mortar, beginning 18 in. below the surface of the ground and extending 18 in. above the general level. The *tower wall* is solid, 13 in. thick, with 13 in. footings. *Outside piers* 13 in. by 3 ft. 6 in., with 13 in. footings; piers placed between windows, at corners, and at intersection of inside sills with rear sill, those at corners returned, and those coming under the flues are 18 in. thick. *Piers* for *inside sills* 9 in. by 30 in., with 9 in. footings, same distance apart as outside piers. *Piers* of *recess* 9 in. by 18 in., 6 in. footings, one at each outer corner, returned. *Piers* to *portico* 9 in. by 13 in., returned. All to be put up substantially and true, with dirt replaced around the base.

TIMBERS.—*Outside sills* 10 in. by 12 in., with 18 in. ship-lap and spiked, the lap to be on the piers; ends halved into each other, and secured with wooden pin 1½ in. and spiked. *Inside sills* two runs equal distances from each other, and from outer sills 9 in. by 12 in., with 18 in. butt-lap well spiked with 40-penny nails, ends tenoned into end sills and pinned. *Portico sills* 4 in. by 10 in., and of *recess* 4 in. by 12 in., tenoned into main sills. *Corner-posts* 8 in. by 8 in., 28 ft. long, tenoned into sills and plates, flush on outside. *Intermediate posts*, three on each side between windows, 6 in. by 8 in., 28 ft., tenoned flush outside and setting back 2 in. from inner edge of sill; two at opening of recess, 6 in. by 6 in., 28 ft. long, set flush inside; and two for inside corners of tower, 6 in. by 10 in., 28 ft., the 6 in. face set flush with inside of sill. *Front corner-posts* of *tower* 10 in. by 10 in., tenoned, flush with sills. *Studs* for main building and tower 2 in. by 6 in., 16 in. from centers, doubled for doors and windows, set back 4 in. from outer edge of sills, leaving a 4 in. pilaster at the posts, on corners and sides, and shouldering the plates at the sides of the main building, 4 in. from the inside, the 2 in. strip (as long as the plate is wide) running alongside, and nailed to the inside of the plate, to prevent the plaster cracking by separating it from the plates. *Studs* for *partitions* and *recess* 2 in. by 4 in., doubled for corners, doors, and windows. These studs all securely nailed to their places, those of second story being bridged or braced, when first put up, to preserve the wall in straight line. *Plates* for first story 4 in. by 8 in., tenoned into posts, flush with outside of studs, the 8 in. faces perpendicular, the upper edge being 10 ft. 2 in. from the sill. *Second plates* 4 in. by 8 in., for the sides, flush with outside of posts; and 4 in. by 6 in. for the ends of building, flush with studs. *First plates* for tower 4 in. by 12 in. for front and sides, laid flat, flush with outside of corner-posts, halved and spiked down at outer corners, and tenoned into the inside posts. *Second plates* for tower 4 in. by 12 in., flush with outside of corner-posts. *Third* and *fourth plates* for tower 4 in. by 8 in., flush with corner-posts, halved and thoroughly spiked together at the corners. *Braces* 4 in. by 6 in., 5 ft. long in first story, and 8 ft. long in second story, jogged into sills, posts, and plates 1 in., and well spiked, let into studs flush on outside and nailed. There are four braces (upper and lower) to each post in each story. *Tower braces*

cross each other, running diagonally from corner to corner, let into each other at crossing, and spiked together. *Girders* (two) 8 in. by 10 in., made of 4 pieces 2 in. by 10 in. spiked together, running full length of the house, and supported by end plates and posts; also, by partition walls and four columns, as shown in Fig. 17. *Columns* supporting girders 5 in. by 5 in. at top and 6 in. by 6 in. at bottom, of sound timber and perfectly straight, resting on the sills and immediately over a pier. These pillars are cased with 1¼ in. boards; casing sets on the floor, edges beveled to show 1½ in., with cap and base. *First joists* are 2 in. by 12 in., 16 in. from centers, one course of cross-bridging of 2 in. by 2 in. stuff to each tier; all joists let into sills 2 in. flush and carefully spiked, every fifth joist being dovetailed at each end. *Second joists* are 2 in. by 12 in., 16 in. from centers, one course of cross-bridging to each tier, joists let down on plates 2 in. and nailed, every fifth one dovetailed into plate 2 in.; they are let into girders 2 in., flush on top, and nailed. A stronger tie is also made by spiking a piece 2 in. by 2 in., 2 ft. long, on the lower side of the girder and side of joists projecting below girder. This tie also keeps plastering from the solid face of girder.

Roof.—The frame of the roof consists of five *principals*, or *trusses*, the construction and finish of which are shown in Fig. 19. The *recess* of the roof is 3 ft. deep and 20 ft. wide. The *principal rafters* are 6 in. by 12 in., made of three pieces 2 in. by 12 in., joints broken, and well spiked together with 40-penny spikes. *Tie-beams* and *king-posts* are 6 in. by 8 in., halved into each other and entering rafter with tenon 2 in. by 8 in., fastened with iron strap ½ in. by 2½ in. passing round the rafter, running back on each side 18 in. from outer edge of rafter, and secured with ¾ in. iron bolts with nuts and washers, one bolt passing through the tenon. The same construction is observed with the lower beams —which rest on the plates. Other timbers of the truss 6 in. by 8 in., except the inclined brace at the side which is 6 in. by 6 in. *Ties* connecting the trusses together, and running lengthwise at the lower and upper corners of the recess of the truss, are 6 in. by 8 in., each end of tie tenoned into the trusses. A *brace* 4 in by 6 in. (not shown in drawing) is placed each side of king-post (let in 1 in. at the foot), and butting against rafter at right-angles. The uprights at the side are 5 ft. long, exclusive of the pendant, and set in from the wall 15 in., to allow smoke and ventilating flues behind each. The flues are shown in Fig. 18, but not in the plan of the roof. The timbers of the roof are to be all seasoned, the lower pieces dressed, as they show below the ceiling. All joints are to be made CLOSE AND SOLID. The trusses are secured to their places by 1 in. iron bolts, the head of bolt sunk into the main posts of the house 8 in. below the plate, passing outoutward through the plate and rafter, fastened with a nut on top of the rafter, and sunken sufficiently to be covered by the sheathing. The *small rafters* between the trusses are 2 in. by 6 in., 2 ft. apart, let down 2 in. and spiked on to plate, and braced about the middle with 2 in. by 2 in. stuff from the upper lengthwise tie. *Ceiling-joists* 2 in. by 6 in., 2 ft. apart, supported by the trusses, as shown, let down 1 in. and nailed to their places. The roof is covered with 1 in. sheathing, and the best quality of white-pine or heart-cypress shingles, 18 in. long, with 5½ in. to the weather. Roof projects at gables 20 in., and at sides 24 in.

Outside Finish.—The *base* isc onstructed, as shown in elevation, Fig. 16, of dressed



Des. 5. **Fig. 16.**

boards 1¼ in. thick, well seasoned, end joints of cap or slanting boards covered with a 3 in. strip of tin. The *facia* is 12 in. wide, dropped ¾ in. below the sills, furred out 1 in. from the sills, put on straight and true. The cap is 9 in. wide, projecting outside of the *facia* 1½ in., outside or lower edge beveled to perpendicular line, upper edge beveled to horizontal line and receiving a 2 in. water-table between it and weather-boarding. Use 6 in. clear, dressed *weather-boarding* gauged and put on to show in straight lines 4¾ in. to the weather, with close joints against the pilasters. The corner-posts and those midway between the side windows are cased outside with 1 in. plank, forming a *pilaster* 4 in. by 14 in. The casings of the corner-posts show the same facing front and side, and side and rear. The pilaster of the front offset—that is, at the corner of the vestibule—faces 10 in. instead of 14 in., as the others. *Pilasters* of first section of the tower 14 in.; second section 12 in.; third section 10 in. The caps at offsets of tower finish same as cap of base, with small molding underneath the projection. The *fricze* to the building is 1 in. thick and 20 in. wide, of well-seasoned, clear lumber. The *cornice* is formed on the projecting ends of rafters at the sides and on lookouts at both ends. The *soffit*, or under side of the cornice, finishes with double-beaded ceiling, ¾ in. thick and 6 in. wide; the *facia* 6 in., with 6 in. *crown-molding*. Bed-molding at sides and rear end 3 in. by 4½ in. *Dentel* and other work on the front as shown in elevation. Cover *porticos* with 1 in. sheathing and tin, the shape of rafters being as shown in plan. Posts of portico 5 in. square, with beveled edges; projection of cornice 12 in. All outside *window-casings* 1½ in. thick by 4½ in. wide.

Belfry and Spire.—*Corner-posts* of tower, outside, are 10 in. by 10 in. for first story; 8 in. by 8 in. for second story, setting back 6 in. on the plate of first story; 6 in. by 6 in. for third section, setting in 12 in., tenoned top and bottom, resting on 6 in. by 8 in. pieces laid diagonally across the corners, and spiked to sills; 6 in. by 6 in. posts for fourth section, or belfry, beginning the same as posts of third section, and at the same place, setting in 2 ft., being secured to the diagonal pieces at bottom by 1 in. iron bolts, and these pieces bolted to sills. This section thoroughly cross-braced, and braced to the outer section, extending high enough to make belfry 8 ft. Plates 4 in. by 8 in.; corner-pieces of spire 4 in. by 4 in., 35 ft., bolted with 1 in. iron bolts through the plate to post of belfry, thoroughly braced to the top with 2 in. by 4 in. braces, 1 in. sheathing, covered with best tin, 5 in. wooden strips cover the corners.

Doors and Windows.—*Front doors* of best quality of white pine, 46 in. by 7 ft., 2 in. thick, 8 panels to the door, as shown in elevation, raised molding, hung with 6 in. wrought-iron, loose-jointed *butts*, 3 butts to the door, good locks with key, and white porcelain knobs; opening as shown in Fig. 17. *Front Sunday-school room doors* 3 ft. 4 in. by 7 ft., 1¾ in. thick, 4 panels, 4 in. butts, good *lock*, white knobs. *Other doors* of first story 3 ft. by 7 ft., 1½ in. thick. All doors hung with loose-jointed butts. All doors of the first story have an 18 in. *transom*, hung on pivots. *Two doors to auditorium* 4 2 in. by 8 ft., double shutters, light, but strong, skeleton frame covered with green baize, closed by wire-spring. All *window-frames* are made box, except in the pulpit-recess. *Windows* of first story 3 ft. 2½ in. by 6 ft. 6 in. (inside of frames), two windows of vestibule 2 ft. by 6 ft. 6 in. *Sash* of same dimensions, 1½ in. thick, with 2 in. mullion, 8 lights. *Window* in the *recess* in rear

2 ft. 6 in. by 5 ft. *Windows* of *auditorium* 3 ft. 2½ in. by 8 ft. 8 in. to spring-line of regular Gothic head. *Middle front window* 45 in. by 10 ft. to spring-line of regular Gothic head. *Windows* of *pulpit-recess* 30 in. by 4 ft. 6 in. to spring-line of Gothic head. *Sash* to auditorium same as above dimensions, 1½ in. thick, 2 in. mullion, 3 in. stiles, 4 in. base, sash in two pieces, and hung in the ordinary manner with cord and weights. *Sash* of *pulpit-recess* in one piece, hung on pivots. All sash of auditorium filled with neat, modest pattern of *stained glass*. All windows set 20 in. from floor.

Stairway.—This may be made as shown, with one run, or passage, or may consist of two passages 3 ft. wide, one at each side of the tower next to entrance, running to the front, meeting on a platform 3½ ft. by 4½ ft., then returning with a passage 4 ft. wide between the other two, landing with face to auditorium. This brings the foot of stairs nearer to, and equally distant from, each entrance, and the landing equally distant from each door of auditorium. The first floor of tower being raised 22 in., requires three steps to reach it from the floor at entrance. (Plan shows but two steps.) *Carriages* 2 in. by 12 in., *steps* 12 in., *risers* 7 in., *rail* 3½ in., *newels* 6 in., inclosed with yellow pine boards, rail and newels of walnut.

Inside Finish.—*Base* 1 in. thick by 10 in. high, upper edge beveled, ¼ round next the floor. *Door* and *window-casing* 6 in. wide, with 3 in. mold. The opening, or recess, at the entrance of auditorium finishes with 6 in. casing and molding, top in half octagon form, extending 1 ft. higher than top of front windows, and giving full view of them from inside the auditorium. The finish of pulpit-recess is *front casing* 9 in. wide, with 4 in. molding, and casing of under edge of opening 6 in. wide, with 1¼ in. *rope molding* filling the corners between the two casings. The form of opening is triple-headed Gothic, similar to Fig. 38, middle head having radius of 5 ft. 3 in., and smaller heads radius of 2 ft. 6 in. The angles of the recess are filled with molding 3 in. wide, 1½ in. thick in the middle, beveled to ¼ in. thickness at each edge. (See Fig. 3.) The *pulpit-platform* is 22 in. high, as shown in Fig. 3, made of selected grain of yellow pine, or grained oak. The *altar* is 20 in. high, made according to directions on page 65, and form as shown in Figs. 18 and 38. The *rail* is of walnut, 6 in. wide, 2 in. thick, upper corners rounded, lower corners taken off with a scotia. The *base*, or *lower rail*, is of walnut, same size as upper rail, scotia on upper corners, the rail raised from the floor to let the kneeling-board rest against the lower edge of it. *Balusters* of selected pine, or ash, 2½ in. diameter, 14 in. long, 2½ in. apart, 1 in. tenon on each end, and glued into rails.

Heating and Ventilation.—In the *study*, a *brick flue* for a grate is built, not as shown by plan, but diagonally across the corner of the room, its base beginning with base of the pier. A flue for stove is in *class-room*, two flues for furnaces (Grotius's No. 3) in *Sunday-school room*, the furnaces having registers opening into Sunday-school room and hot-air pipes and registers to auditorium above. All the brick flues begin their base at the base of piers, run up 9 in. cavity, 4½ in. wall, mortar well laid between bricks, to leave no crevice, and thoroughly pargetted. Insert a circle of iron—that is, the shape of the flue (the corners of the flue being cut off to show 4 in. face)—2 in. wide and ¾ in. thick, laid flat on brick, running around outer edge of flue, at lower end of the brace of roof extending down inside wall, touching both the post in the wall and said brace of the roof, to pre-

boards 1¼ in. thick, well seasoned, end joints of cap or slanting boards covered with a 3 in. strip of tin. The *facia* is 12 in. wide, dropped ¾ in. below the sills, furred out 1 in. from the sills, put on straight and true. The cap is 9 in. wide, projecting outside of the *facia* 1½ in., outside or lower edge beveled to perpendicular line, upper edge beveled to horizontal line and receiving a 2 in. water-table between it and weather-boarding. Use 6 in. clear, dressed *weather-boarding* gauged and put on to show in straight lines 4¾ in. to the weather, with close joints against the pilasters. The corner-posts and those midway between the side windows are cased outside with 1 in. plank, forming a *pilaster* 4 in. by 14 in. The casings of the corner-posts show the same facing front and side, and side and rear. The pilaster of the front offset—that is, at the corner of the vestibule—faces 10 in. instead of 14 in., as the others. *Pilasters* of first section of the tower 14 in.; second section 12 in.; third section 10 in. The caps at offsets of tower finish same as cap of base, with small molding underneath the projection. The *fricze* to the building is 1 in. thick and 20 in. wide, of well-seasoned, clear lumber. The *cornice* is formed on the projecting ends of rafters at the sides and on lookouts at both ends. The *soffit*, or under side of the cornice, finishes with double-beaded ceiling, ¾ in. thick and 6 in. wide; the *facia* 6 in., with 6 in. *crown-molding*. Bed-molding at sides and rear end 3 in. by 4½ in. *Dentel* and other work on the front as shown in elevation. Cover *porticos* with 1 in. sheathing and tin, the shape of rafters being as shown in plan. Posts of portico 5 in. square, with beveled edges; projection of cornice 12 in. All outside *window-casings* 1½ in. thick by 4½ in. wide.

Belfry and Spire.—*Corner-posts* of tower, outside, are 10 in. by 10 in. for first story; 8 in. by 8 in. for second story, setting back 6 in. on the plate of first story; 6 in. by 6 in. for third section, setting in 12 in., tenoned top and bottom, resting on 6 in. by 8 in. pieces laid diagonally across the corners, and spiked to sills; 6 in. by 6 in. posts for fourth section, or belfry, beginning the same as posts of third section, and at the same place, setting in 2 ft., being secured to the diagonal pieces at bottom by 1 in. iron bolts, and these pieces bolted to sills. This section thoroughly cross-braced, and braced to the outer section, extending high enough to make belfry 8 ft. Plates 4 in. by 8 in.; corner-pieces of spire 4 in. by 4 in., 35 ft., bolted with 1 in. iron bolts through the plate to post of belfry, thoroughly braced to the top with 2 in. by 4 in. braces, 1 in. sheathing, covered with best tin, 5 in. wooden strips cover the corners.

Doors and Windows.—*Front doors* of best quality of white pine, 46 in. by 7 ft., 2 in. thick, 8 panels to the door, as shown in elevation, raised molding, hung with 6 in. wrought-iron, loose-jointed *butts*, 3 butts to the door, good locks with key, and white porcelain knobs; opening as shown in Fig. 17. *Front Sunday-school room doors* 3 ft. 4 in. by 7 ft., 1¾ in. thick, 4 panels, 4 in. butts, good *lock*, white knobs. *Other doors* of first story 3 ft. by 7 ft., 1½ in. thick. All doors hung with loose-jointed butts. All doors of the first story have an 18 in. *transom*, hung on pivots. *Two doors to auditorium* 42 in. by 8 ft., double shutters, light, but strong, skeleton frame covered with green baize, closed by wire-spring. All *window-frames* are made box, except in the pulpit-recess. *Windows* of first story 3 ft. 2½ in. by 6 ft. 6 in. (inside of frames), two windows of vestibule 2 ft. by 6 ft. 6 in. *Sash* of same dimensions, 1½ in. thick, with 2 in. mullion, 8 lights. *Window* in the *recess* in rear

2 ft. 6 in. by 5 ft. *Windows* of *auditorium* 3 ft. 2½ in. by 8 ft. 8 in. to spring-line of regular Gothic head. *Middle front window* 45 in. by 10 ft. to spring-line of regular Gothic head. *Windows* of *pulpit-recess* 30 in. by 4 ft. 6 in. to spring-line of Gothic head. *Sash* to auditorium same as above dimensions, 1½ in. thick, 2 in. mullion, 3 in. stiles, 4 in. base, sash in two pieces, and hung in the ordinary manner with cord and weights. *Sash* of *pulpit-recess* in one piece, hung on pivots. All sash of auditorium filled with neat, modest pattern of *stained glass*. All windows set 20 in. from floor.

STAIRWAY.—This may be made as shown, with one run, or passage, or may consist of two passages 3 ft. wide, one at each side of the tower next to entrance, running to the front, meeting on a platform 3½ ft. by 4½ ft., then returning with a passage 4 ft. wide between the other two, landing with face to auditorium. This brings the foot of stairs nearer to, and equally distant from, each entrance, and the landing equally distant from each door of auditorium. The first floor of tower being raised 22 in., requires three steps to reach it from the floor at entrance. (Plan shows but two steps.) *Carriages* 2 in. by 12 in., *steps* 12 in., *risers* 7 in., *rail* 3½ in., *newels* 6 in., inclosed with yellow pine boards, rail and newels of walnut.

INSIDE FINISH.—*Base* 1 in. thick by 10 in. high, upper edge beveled, ¼ round next the floor. *Door* and *window-casing* 6 in. wide, with 3 in. mold. The opening, or recess, at the entrance of auditorium finishes with 6 in. casing and molding, top in half octagon form, extending 1 ft. higher than top of front windows, and giving full view of them from inside the auditorium. The finish of pulpit-recess is *front casing* 9 in. wide, with 4 in. molding, and casing of under edge of opening 6 in. wide, with 1¼ in. *rope molding* filling the corners between the two casings. The form of opening is triple-headed Gothic, similar to Fig. 38, middle head having radius of 5 ft. 3 in., and smaller heads radius of 2 ft. 6 in. The angles of the recess are filled with molding 3 in. wide, 1½ in. thick in the middle, beveled to ¼ in. thickness at each edge. (See Fig. 3.) The *pulpit-platform* is 22 in. high, as shown in Fig. 3, made of selected grain of yellow pine, or grained oak. The *altar* is 20 in. high, made according to directions on page 65, and form as shown in Figs. 18 and 38. The *rail* is of walnut, 6 in. wide, 2 in. thick, upper corners rounded, lower corners taken off with a scotia. The *base*, or *lower rail*, is of walnut, same size as upper rail, scotia on upper corners, the rail raised from the floor to let the kneeling-board rest against the lower edge of it. *Balusters* of selected pine, or ash, 2½ in. diameter, 14 in. long, 2½ in. apart, 1 in. tenon on each end, and glued into rails.

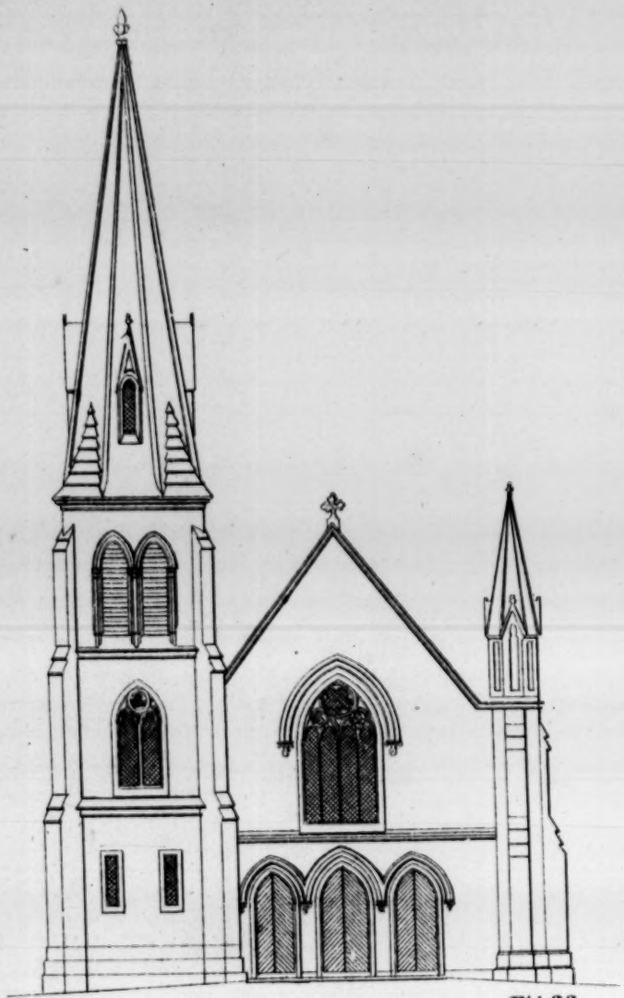
HEATING AND VENTILATION.—In the *study*, a *brick flue* for a grate is built, not as shown by plan, but diagonally across the corner of the room, its base beginning with base of the pier. A flue for stove is in *class-room*, two flues for furnaces (Grotius's No. 3) in *Sunday-school room*, the furnaces having registers opening into Sunday-school room and hot-air pipes and registers to auditorium above. All the brick flues begin their base at the base of piers, run up 9 in. cavity, 4½ in. wall, mortar well laid between bricks, to leave no crevice, and thoroughly pargetted. Insert a circle of iron—that is, the shape of the flue (the corners of the flue being cut off to show 4 in. face)—2 in. wide and ¾ in. thick, laid flat on brick, running around outer edge of flue, at lower end of the brace of roof extending down inside wall, touching both the post in the wall and said brace of the roof, to pre-

vent any pressure on the flue from settling of the roof. The smoke-pipes enter flues 2 ft. below first ceiling. Each flue divides to pass the rafter, the flare beginning 2 ft. 6 in. below the rafter, and runs out single or double chimneys outside, as may be preferred. These flues, properly built, are perfectly secure against fire. The deflection below the rafter, being both ways, gives the flue, when plastered, the appearance of a supporting column. A separate panel is thus cut off for each window with the upper corners rounded. The brick flues are shown in Fig. 17 (first story); but in Fig. 18 (auditorium) other corresponding flues of 2 in. by 4 in. studs and plaster are added, which serve as ventilating flues. The study and class-room each have a ventilating register in the ceiling, opening into the flues above them, while the main flues, between the brick ones on each side of the house, ventilate the auditorium and Sunday-school room. A register for each of these two flues is set in the aisle opposite them and connected with them by a duct made of two joists in their places, flooring above and plastering below. A register is also placed in the ceiling of Sunday-school room under the flues. These flues terminate above the roof with ornamental shaft and cap. This arrangement affords thorough ventilation for the large auditorium, carrying out the foul cold air in winter, and bringing in fresh air in summer.

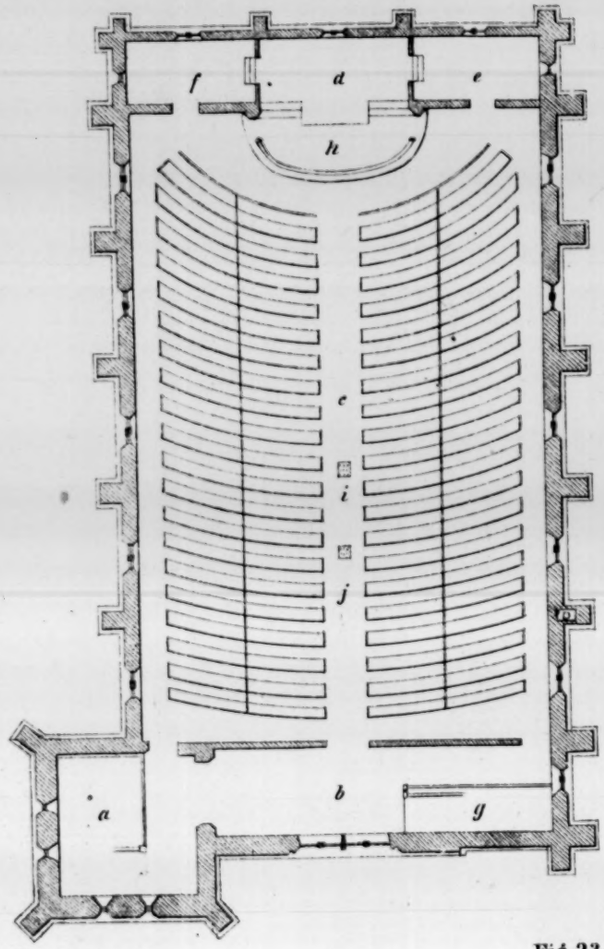
LIGHTING.—The *class-room* is lighted by a three-light chandelier in the center of the room. The *Sunday-school room* has eight two-light chandeliers, placed at the center of each square of the ceiling made by the walls and columns. The *auditorium* is lighted by two of Frink's 40-inch silver-plated corrugated glass reflectors, eight lights each, style of Fig. 20 or 21. Also, one ornamental bracket light each side of pulpit, attached to front casing of recess, and two two-light chandeliers in the vestibule-recesses and just in front of the side-front windows. A double bracket in the vestibule proper above and below.

PLASTERING.—The rooms of the first story have one brown coat and white hard finish on ceilings, and three-coat work on the walls. The auditorium has one brown coat on the ceiling and two on the walls, troweled up smooth and hard, to be tinted any desired color, or papered. The corners of the flues are cut off to show a face of 4 in. In vestibule, regular three-coat work, the third coat being the sand-finish.

PAINTING.—The *outside* is painted three-coat, a light stone color for body, and darker shade for trimmings. Tin-work of spire and porticos the color of trimmings of house, and the wooden corner-strips and finial of the spire the color of the body of house. *Inside painting* of first story is stained or grained walnut, second story oak and walnut well varnished. Timbers in ceiling, and casings and sash, painted white.



Des.6. Fig.22.



Des.6. Fig.23.

Struthers & Co. Lith. Co.

DESIGN NO. 6.

ONE-STORY BRICK CHURCH.

THIS Design is from plans prepared for the erection of the Methodist Church at Franklin, Tenn.* It has met with great favor, having been used at several other places. Fig. 22 presents an elegant front elevation after the Gothic style, and Fig. 23 shows the convenient and comfortable arrangements inside. Space is well economized. The arrangement of pulpit, altar, and pews brings the preacher and his congregation near together. Some may prefer to dispense with the middle aisle, and have two others 3 ft. 6 in. wide, dividing the pews into three tiers, the middle tier being 14 ft. long, and the others 9 ft., with an aisle next the wall 2 ft. 6 in. wide. The curve in the pews will add to their cost, but gives the advantage to each hearer of having the speaker directly in front of him. In a community where materials and labor bear a moderate price, a house can be erected after this Design at a cost of $10,000.

SPECIFICATIONS FOR DESIGN NO. 6.

DIMENSIONS.—The *tower* (*a*) is 12 ft. square inside; *vestibule* (*b*) 9 ft. wide; *auditorium* (*c*) 44 ft. by 70 ft., with ceiling 20 ft. at the wall; the pulpit-recess (*d*) is 7 ft. by 15 ft.; small rooms (*e* and *f*) 6 ft. by 13 ft. 9 in.

BRICK-WORK.—*Foundation* 22 in. thick, with 13 in. footings, beginning 24 in. under ground; *main walls* 18 in. thick; *partition walls* 13 in.; *tower*, first section 22 in., second section 18 in., and third section 13 in. walls, the *foundation* being 30 in. thick, with 13 in. footings; two dwarf walls to support joists 9 in., with 6 in. footings; wall of furnace-room 9 in.; *buttresses* 18 in. by 22 in. at base—first offset 13 in., second 9 in.; buttresses of tower 18 in. by 30 in. at base—offsets at base 2 in. each, other offsets 9 in. each; projecting courses as shown in Elevation. No salmon brick is allowed in the foundation or outside work; the front is of selected red brick, uniform in color, and well burned.

TIMBERS.—The dimensions of timbers and construction as in auditorium of Des. No. 4.

OUTSIDE FINISH.—The arrangement and finish of outside work are shown in plans. Spire and turret are covered with tin, the corners finished with 3 in. wooden strips (both sides making 6 in.), outside of tin, for the spire; corners of turret-spire covered with 2 in. round.

INSIDE FINISH.—Same as Des. No. 4.

DOORS.—*Front doors* are 4 ft. by 7 ft. to spring of arch. Inside doors 3 ft. 6 in., except door by middle aisle, 4 ft. 6 in.

WINDOWS.—The windows are splayed in brick outside and inside, as shown in plans. *Side windows* are 3 ft. 3 in. by 9 ft. to spring of arch, made as shown in second section of

*The Rev. R. K. Brown, of the Tennessee Conference, says the Franklin Church is "one of the neatest and most attractive churches in our Connection."

tower. Windows in rear are 2 ft. 6 in. by 8 ft. and 1 ft. 6 in. by 8 ft. *Front windows* 6 ft. by 8 ft. to spring. All have stained glass.

Roof.—Same as in Des. No. 10, covered with tin.

Plastering and Painting.—First class three-coat work.

Heating and Ventilation.—As in Des. No. 4, stairway to furnace-room at *g* 2 ft. 6 in. wide. The registers are in the middle aisle—*j* for hot air and *i* for ventilation. One flue in the wall takes off smoke and vitiated air, the smoke-pipe being continued up the flue.

DESIGN NO. 7.

ONE-STORY CHURCH, BRICK OR FRAME.

Figure 24 shows a Design for a very neat village or city church. The Specifications contemplate the use of brick, but wood can be used by making a few slight alterations. In brick, the house can be erected for $5,500, or in wood for $4,000.

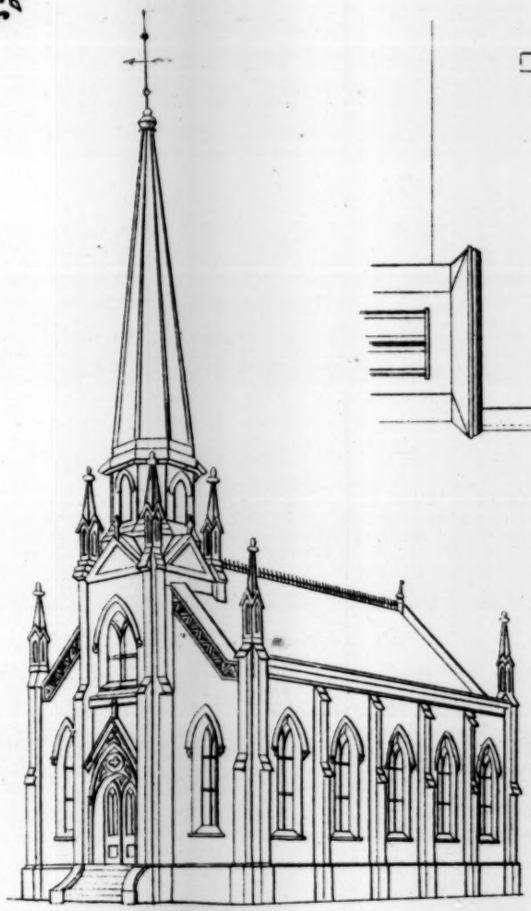
SPECIFICATIONS FOR DESIGN NO. 7.

The front and side elevations are shown in Fig. 24, and ground-plan in Fig. 2, the gallery being included or omitted, as may be preferred.

Dimensions.—*Auditorium* 38 ft. by 65 ft. inside; ceiling 18 ft. at the walls. *Vestibule* or *tower* 10 ft. square inside, projecting 4 ft. in front, and ceiling 12 ft. high.

Brick-work.—*Foundation* walls are 22 in. thick, 13 in. footings, 24 in. deep, and 3 ft. 6 in. from ground to top of first joists. *Main* walls 18 in., beginning at top of first joists where an offset of 4 in. is made outside. *Tower* walls 22 in. for foundation and first section, and 18 in. for second section. *Buttresses* 13 in. by 18 in., and 13 in. by 9 in. Cornice projects 9 in. Flue for smoke and ventilation same as in Fig. 22 in Des. No. 6; or, if stoves are used, four flues will be required—each one constructed as in Fig. 22.

Timbers.—Three tiers of *joists for floor*, 2 in. by 12 in., 16 in. from centers; one course of bridging to each tier. *Ceiling-joists* for vestibule 2 in. by 6 in. *Foundation of spire* laid at offset in tower of timbers 6 in. by 10 in., lapping on each other and extending into the brick wall 6 in. The *posts* of tower 8 in. by 8 in., set on this foundation, tenoned at bottom, setting in from the wall 2 in., braced with 4 in. by 6 in. *braces*, receiving *plate* at top 7 in. by 8 in. On this plate, which is 1 ft. below termination of brick, rests *frame-work* of 8 in. by 8 in. pieces, on which is built the frame of the belfry 6 ft. square. *Belfry-posts* 6 in. by 6 in., full length 9 ft., strongly braced with 3 in. by 6 in. pieces, and tenoned into frame-work at bottom and into *plate* above, which is 4 in. by 8 in. *Corner-pieces* of spire 4 in. by 4 in., secured to plate of belfry by 1 in. iron bolts. Four 1 in. *iron rods* fasten the plate of belfry to upper ends of the lower posts. Spire is braced with 2 in. by 4 in. stuff, in four lengths, or divisions, from top to bottom, covered with 1 in. sheathing and tin, with 4 in. wooden strips at corners. Full height of tower and spire is 95 ft.



Des.7.

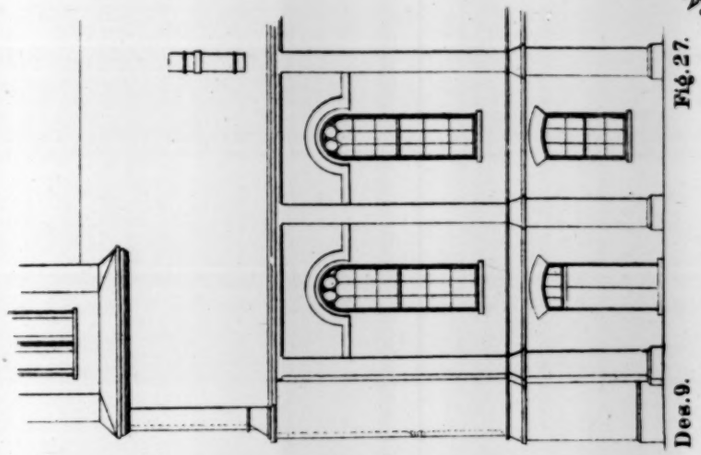
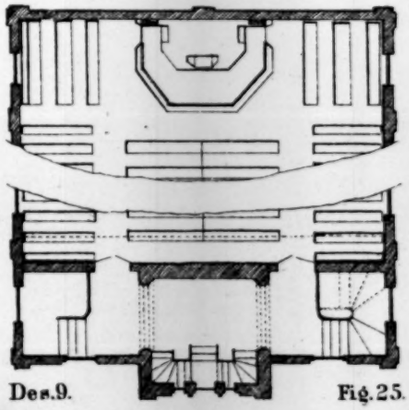


Fig.27.

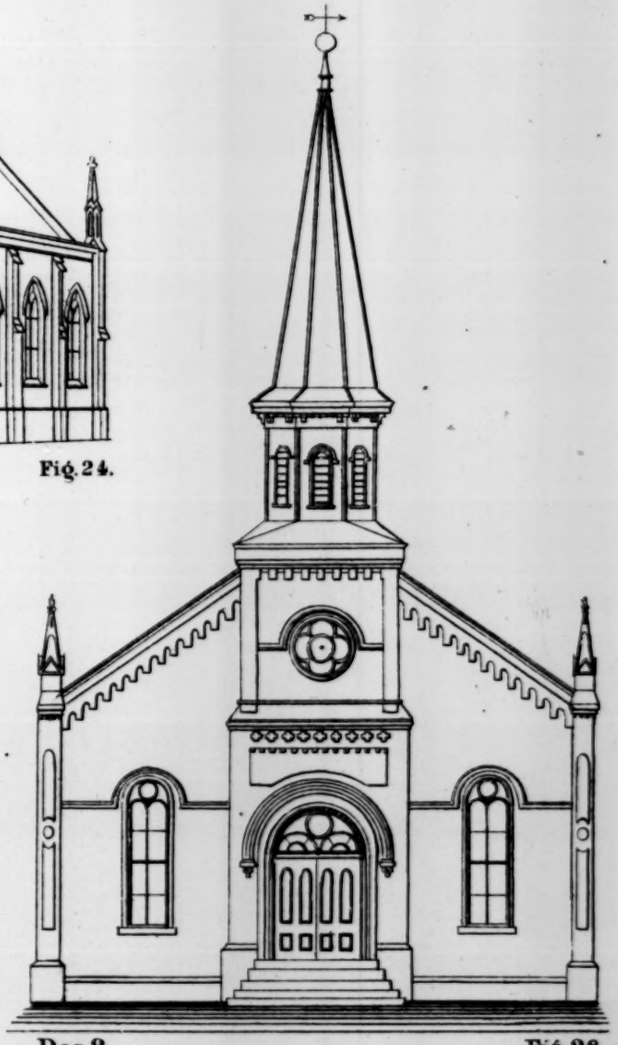
Des.9.

Fig.24.



Des.9.

Fig.25.



Des.8.

Fig.26.

Streetridge & Co. Lith. Cin.

DOORS.—*Front door* 5 ft. 6 in. wide, 8 ft. to spring of arch, 2 in. thick, double shutters, paneled, with raised molding, hung with 12 in. strap-hinges of wrought iron; the door surmounted with terra cotta (or brick) hooding, as shown in plans. *Inside doors* 3 ft. 4 in. by 8 ft., square heads, paneled shutters, 1¾ in. thick, hung with 4½ in. loose-joint butts.

WINDOWS.—*Windows*, front, side, and in pulpit-recess, are same as in Des. No. 5. *Window in tower* 4 ft. by 6 ft. to spring-line of arch. (The place of this tower-window may be supplied with an ornamental ventilator, as in Fig. 16.) *Windows in belfry* 2 ft. 6 in. by 4 ft. 6 in. to spring of arch, closed with the usual horizontal slats 1 in. thick, 4 in. wide, and 3 in. apart.

PINNACLES.—The *pinnacles* are formed of wood, or galvanized iron, 6 ft. in length, and set down over the end of the buttress 1 ft. and fastened.

ROOF.—*Timbers* and *framing* of the roof same as in Fig. 19 of Des. No. 5. The covering of shingles, tin, or sheet-iron. Tin, or iron, gutters running to the rear and emptying through 3 in. pipes.

INSIDE FINISH.—*Floor* of well-seasoned yellow pine boards, dressed, tongue-and-grooved, 1 in. thick, and not over 5 in. wide. *Base-board* 1 in. by 12 in., upper edge beveled. *Casings* as in Des. No. 5.

PULPIT-RECESS.—The pulpit-recess, platform, etc., made as directed in Specifications for Des. No. 5.

PLASTERING AND PAINTING.—These are the best three-coat work.

FINALLY.—All material used is of the best quality, and all work performed in the best workmanlike manner.

DESIGN NO. 8.

ONE-STORY BRICK CHURCH.

THIS Design is for a substantial building, economical in its construction, yet presenting a very fair appearance. It is after the style of Des. No. 9, differing from it mainly in being but one-story high. The auditoriums of the two Designs are about the same. The front elevation is shown in Fig. 26, and the ground-plan in Fig. 25. In the vestibule, however (Fig. 25), the door takes the place of the triple-headed window, and the gallery stairway is at the end of the vestibule. This house can be built for $6,000.

SPECIFICATIONS FOR DESIGN NO. 8.

DIMENSIONS.—*Auditorium* 42 ft. by 70 ft. inside, ceiling 20 ft. in the clear. *Vestibule* 8 ft. wide, with 9 ft. ceiling. First section of *tower* 11 ft. square inside, projecting in front.

BRICK-WORK.—*Foundation walls* 22 in. thick, with 13 in. footings. *Main walls* 18 in. *Tower walls* 27 in., with 13 in. footings for foundations, 18 in. for first section, and 13 in. for second section. The ornamental work on front elevation is all made of bricks, project-

ing or recessed. Projecting course above front windows is continued on sides. Pilasters are 9 in. by 30 in. for foundation, the balance 4 in. by 22 in., with termination of galvanized iron (or wood) 5 ft. high, securely fastened down over brick-work. *Smoke-flues* 9 in. square are built for stoves in pilasters, as shown in Fig. 29. Heating can be done with one furnace by digging a cellar, which would require but one flue.

TIMBERS.—*Floor joists* 2 in. by 12 in. *Gallery joists* 2 in. by 8 in., 16 in. from centers, having a fall of 6 in. in the length, and projecting 3 ft. beyond vestibule wall. (See Fig. 31.)

ROOF.—Same as in Des. No. 9.

SPIRE.—Timbers and construction of spire same as in Des. No. 7.

DOORS.—*Front door* 6 ft. by 9 ft. to spring of arch; shutters double, 2 in. thick, paneled, etc., as shown in plan; hung complete. *Inside doors* are 4 ft. by 7 ft., 1½ in. thick, paneled; casings 6 in., with 3 in. moldings.

WINDOWS.—Box frames, sash 1½ in. thick, 3 ft. 6 in. wide, 10 ft. to spring of arch, hung with weights. Jambs of windows splayed and finished with plaster to the frame. Five windows on each side, finished as the front ones.

INSIDE FINISH.—*Flooring* of best quality, 1 in. boards dressed, tongued and grooved, and closely laid. *Platform* as in Fig. 30. The finish over the pulpit is of brick and plaster, projecting 6 in. from the wall.

PLASTERING.—The best lath-and-plaster, three-coat work.

PAINTING.—Best lead-and-oil painting, three-coat work, colors as agreed upon.

DESIGN NO. 9.

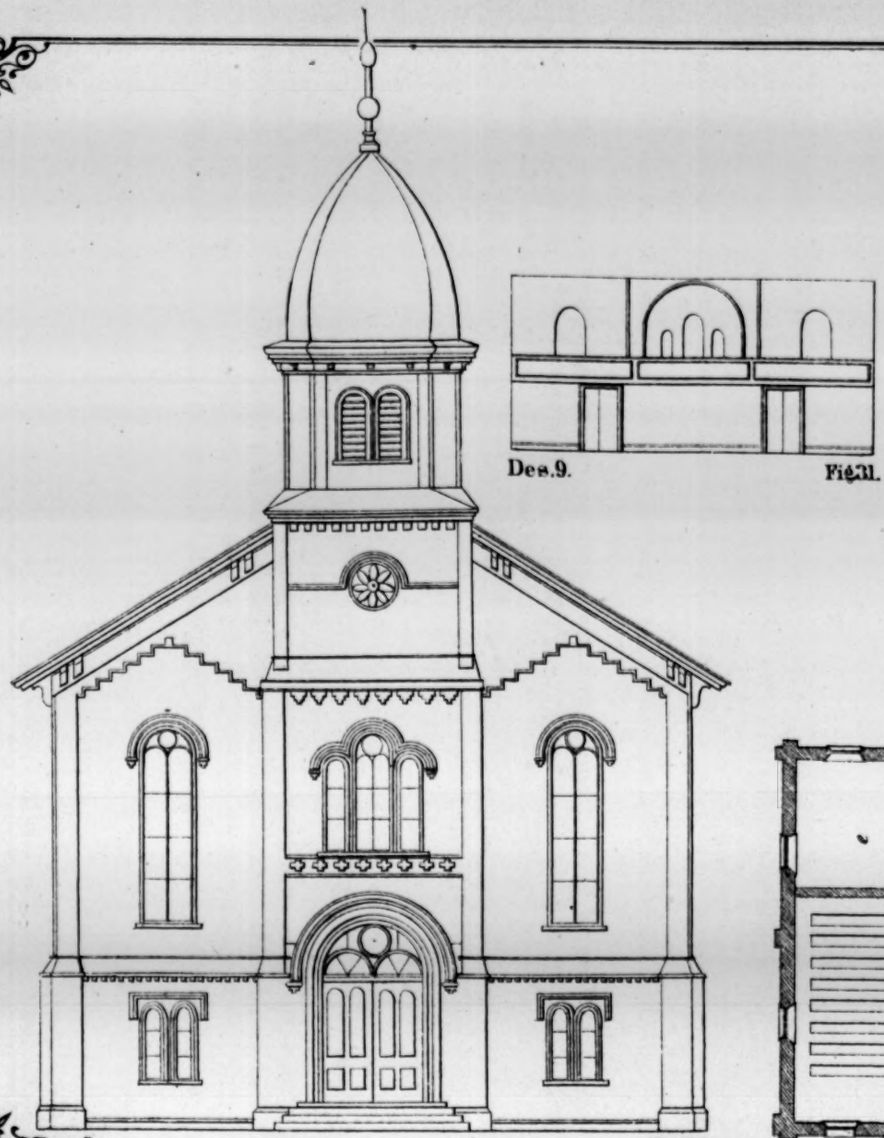
A TWO-STORY BRICK CHURCH.

THIS house is similar in architecture and construction to Des. No. 8, the principal difference being in the additional rooms furnished in the first story of the present plan. The spire of Des. No. 8, or any other, can be used with this plan. Fig. 28 shows the front elevation, in which is given a cheap plan for building, and yet a plan that has been much admired. This house can be erected complete for $9,000, and for less than that amount where work and materials are at low prices.

SPECIFICATIONS FOR DESIGN NO. 9.

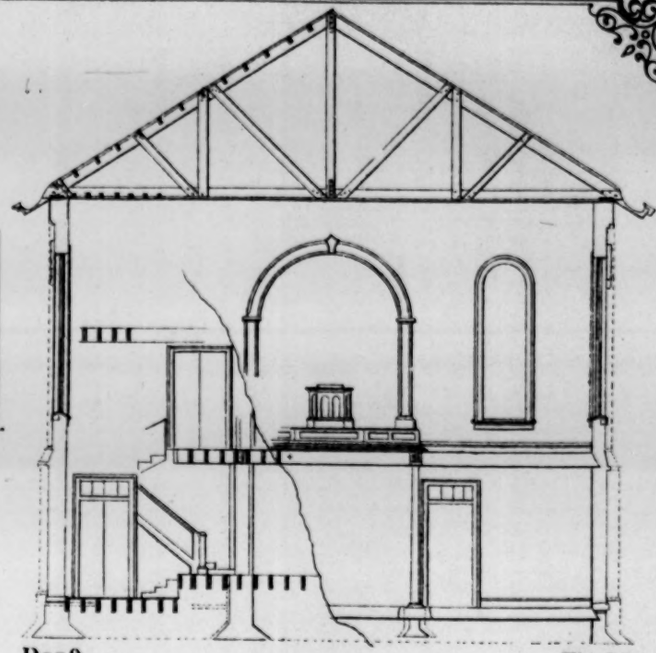
PLATES SHOWING DESIGN.—Fig. 28 is front elevation; Fig. 27, side elevation; Fig. 29, rooms on the first floor; Fig. 30, transverse section, representing the construction of the building; Fig. 31, view of the gallery; Fig. 25, auditorium.

DIMENSIONS.—*Auditorium* 42 ft. by 70 ft. inside, ceiling 21 ft. high. *Tower* (*a* in Fig. 29), first section 12 ft. square inside, with ceiling 8 ft. high, arched openings into vestibules on right and left. The *Sunday-school room* (*b*) is 42 ft. by 49 ft. 3 in., with ceiling 10 ft. high. *Class* or *prayer-meeting room* (*c*) is 20 ft. by 27 ft., ceiling 10 ft. *Pastor's study* (*e*) 14 ft. by 14 ft., ceiling 10 ft. *Hall* (*d*) 5 ft. wide. *Vestibules* 9 ft. wide. *Gallery* 13 ft. by 42 ft.



Des.9. Fig.28.

Des.9. Fig.31.



Des.9. Fig.30.

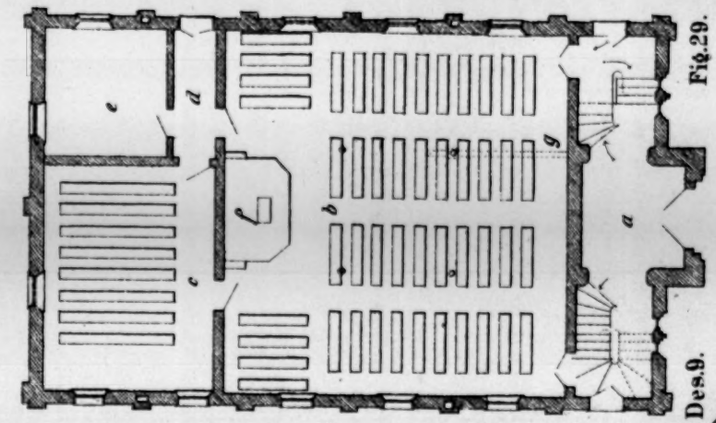


Fig.29. Des.9.

Strobridge & Co. Lith. Cin.

BRICK-WORK.—*Foundation* of *main walls* 22 in. All *footings* 9 in. *Main walls* of first and second stories 18 in., with 2 in. by 4 in. bond timbers above and below openings. *Foundation* of *tower* 27 in., 9 in. footings. Foundations begin 2 ft. below surface of ground. First section of tower 22 in.; second section 18 in., with arched opening in gallery, as shown in Fig. 31; third section 13 in., setting back on outside 9 in., and setting in on the inside 4 in., the 4 in. inside projection resting on the foundation timbers of the belfry. Sills for windows and doors, outside, of stone, 6 in. thick. *Dwarf walls* (*g*, one on each side) to support first joists 9 in., and under the columns these walls are increased to 13 in. square, and run up even with top of joists to receive foot of column. *Flues* are built as shown by plan, 9 in. square, commencing 3 ft. from first floor, smooth plastered inside, with opening for 7 in. pipe, chimney being 6 ft. high above the roof.

WOOD-WORK.—*Joists* for main floors 2 in. by 12 in., 16 in. from centers, in first story lapped on the dwarf walls, and in second story tenoned into girders, as shown in Fig. 30, all joists well spiked at each end. *Gallery-joists* 2 in. by 10 in., 2 ft. apart, projecting 3 ft. past the partition wall into auditorium, 9 ft. 6 in. high at outer wall, and 8 ft. from the floor at other end of joists, making a slant of 18 in. One course of *bridging* to each tier of joists. *Girders* for second floor 8 in. by 10 in., of 4 pieces 2 in. by 10 in. spiked together, supported by the outer and partition walls, and by 4 *iron columns* 6 in. diameter, $\frac{3}{4}$ in. metal, foot-plate 12 in. square with socket to receive column, and a molded cap with 9 in. square head. The joists of second floor, being 2 in. wider than girder, have a 2 in. by 2 in. piece 2 ft. long nailed to the end of joists, at the lower edge, across the girder, which serves as a tie, and also throws off the plastering from the solid face of the girder.

ROOF.—The roof consists of seven *trusses*, or *bents*, the construction of which is shown in Fig. 30. The *principal rafters* are 6 in. by 12 in., of three 2 in. pieces spiked together. *Tie-beam* 6 in. by 9 in., made like the rafter, let down on plate 1 in. *King-post* 6 in. by 8 in., of three 2 in. pieces, the two outer pieces forming dove-tail joint at top and bottom with the outer pieces of rafter and tie-beam, fastened with *iron strap* $\frac{3}{4}$ in. by 3 in., extending along king-post 18 in. on each side, and bolted with $\frac{3}{4}$ in. *iron bolts*, 4 bolts to each strap. Same size strap used at intersection of tie-beam and rafter, as shown in plan. *Braces* of 2 in. by 6 in. stuff, one piece on each side of tie-beam and rafter, well spiked on with 40-penny nails. *Purlins* 2 in. by 6 in., 2 ft. apart, supported by a 2 in. by 2 in. piece nailed on to the rafter. *Ceiling-joists* 2 in. by 6 in., 16 in. apart, supported as purlins, projecting below tie-beam 1 in. *Plates* 4 in. by 10 in., well pinned at lappings, and anchored to the wall with 1 in. iron rod 3 ft. long, four anchors to each side of the house. *Cornice* projects 2 ft. at sides and ends, as shown in plans. *Sheathing* of 1 in. plank, and covered with best quality of *tin*.

DOORS.—*Front door* is 6 ft. by 8 ft. to spring of arch, frame of 2 in. stuff, rebated to receive shutters; shutters double, 2 in. thick, paneled, raised molding, hung with strap-hinges of fine finish, 12 in. long. Other outside doors, and doors from vestibule to Sunday-school room, 3 ft. 8 in. by 7 ft., with 18 in. transom. Upper vestibule doors 4 ft. by 7 ft., double, $1\frac{1}{2}$ in. thick, paneled, hung with 4 in. loose-joint butts, three pair to the door. All other doors 3 ft. by 7 ft., with 18 in. transom, shutters $1\frac{1}{2}$ in. thick, hung with 4 in. butts. All doors provided with best locks, porcelain knobs, bolts and keys;

double-doors furnished with top and bottom bolts. *Casings* to doors (inside) 6 in., with 3 in. molding.

WINDOWS.—*Windows* are 3 ft. 6 in. wide; in the first story 6 ft. 6 in. high, and in second story same width, and 12 ft. to spring of arch. (Fig. 27.) *Front windows* of second story same size of side windows. Triple window in tower 6 ft. full width, and 6 ft. 6 in. to spring-line of outer sections, the spring-line of middle one even with top of the arch in the others, being separated from these by brick-work, as shown in Fig. 25. Outer sections 1 ft. wide, and middle section 2 ft. wide. Front windows of first story double, each section 1 ft. wide, 6 ft. to spring of arch, 3 ft. from main floor. Other windows 2 ft. from floor. All *frames*, except the front, are regular box frames, sash 1¾ in. thick, hung with cord and weight. *Glass* plain, enameled, or stained, as may be determined. First-story windows not cased inside, but jambs splayed, with sill of wood 2 in. thick, slanting downward as it runs in, projecting 2 in. at edge and ends, as shown in Fig. 29. Second-story windows have 6 in. casing, with 3 in. molding. No window in pulpit end of auditorium, but one false, or blind, window on each side of the pulpit, recessed 4 in. in the wall, and cased as the others. These windows may be filled with a monumental slab, on which to inscribe the names of deceased members of the church.

BELFRY.—Frame-work of belfry commences at the second offset in the tower, with *foundation* of 8 in. by 10 in. pieces across the corners, resting on the pieces supporting the inside projection of the walls, and extending into the wall 8 in. *Corner-posts*, 8 in. by 8 in., are tenoned into these cross pieces, and cross-braced with 4 in. by 6 in. *braces*. *Plates* to this section 4 in. by 10 in., supporting the post of the next section, or belfry proper, and also the frame of the bell. There are 8 *posts* to belfry 6 in. by 6 in., well braced with 4 in. by 6 in. stuff, the two at corners half the distance apart of those at the sides. *Plates* 4 in. by 6 in. *Rafters* 2 in. by 6 in., covered with 1 in. sheathing, and best quality of tin. General finish of the belfry shown in plan.

FLOORING AND BASE.—*Flooring* of clear, well-seasoned, dressed boards, 1 in. thick, and not over 5 in. wide, tongued and grooved, secret nailed. *Base* of 1 in. board, 9 in. wide, with 3 in. molding.

GALLERY.—*Frame-work* already described. *Finish* as shown in Fig. 31.

PULPIT AND PLATFORM.—Figs. 25 and 30 show the form and construction. Height of *pulpit* 34 in., and 30 in. wide. *Platform* 30 in. high. *Altar-railing* 22 in. high, made as in Des. No. 10. Floor inside the altar raised 6 in. high. The *arch* in rear of the pulpit is of brick, 13 in. wide, projecting 4 in., with edges chamfered 2 in. each way, covered with smooth, straight plaster Paris finish.

STAIR-WAYS.—The *stair-ways* at each end of the vestibule are alike. Four steps 6 in. high, 1 ft. wide, and 4 ft. 6 in. long in the vestibule from the level of first floor to the floor in middle of vestibule, as shown in Fig. 30. *Main stair-ways* have 16 steps, 6¾ in. high, tread of 1¼ in. hard wood, 12 in. wide, 4 ft. long. *Newel posts* 6 in., *railing* 4 in., *frame* of 2 in. by 12 in. pieces strongly put together, cased up solid to the rail with panel, as shown in plans. The *stair-way to gallery*, in Fig. 25, has the first three steps 3 ft. long; other steps, turning right and left, 2 ft. 6 in. long.

PLASTERING.—The *plastering* consists of two brown coats, thoroughly troweled, and

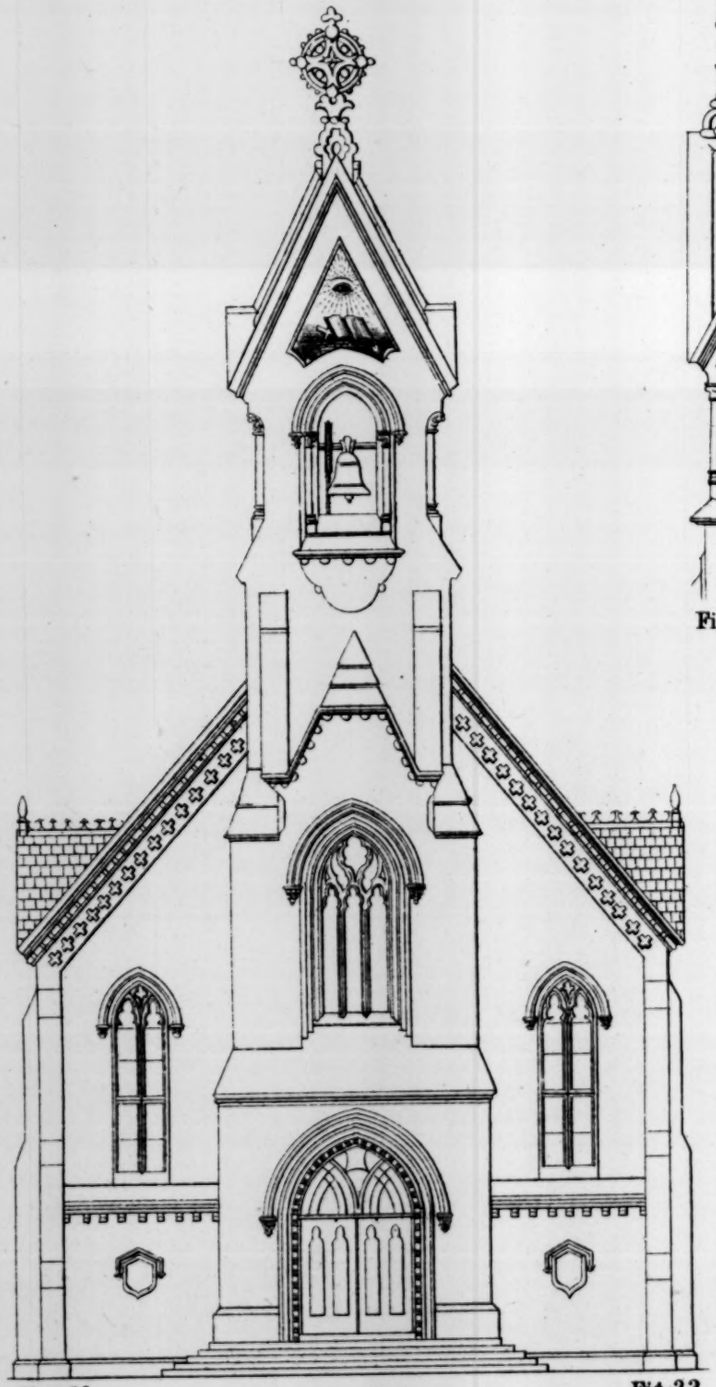


Fig 33.

Des.10.

Fig.32.

Strobridge & Co. Lith. Cin.

tinted very light gray. Three panels in the ceiling run with 6 in. light molding of plaster Paris, the panels 5 ft. from the walls and from each other. A molding of plaster Paris 1 ft. girt at intersection of ceiling and walls.

PAINTING.—Three-coat work of best lead-and-oil paint, any colors that may be agreed upon. Tin roof has three coats of light-brown or gray paint. Doors, gallery, pulpit-platform, and altar grained oak, with walnut trimmings. Inside casings of zinc-white finish.

FINALLY.—All material furnished is of the very best quality, and all work done in the most workmanlike manner.

DESIGN NO. 10.

TWO-STORY BRICK CHURCH.

UTILITY, beauty, and economy characterize this Design. It reaches what we consider should be, as a general rule, the limit in sittings for our largest churches.* Almost every convenience is provided in its arrangement. It is substantial in material and construction, and beautiful, but not gorgeous and extravagant, in ornamentation. The Central Methodist Church in Memphis, built from this Design, has been pronounced by ministers and laymen from various sections of the country, a "*model church.*" Its erection complete did not exceed $25,000.

SPECIFICATIONS FOR DESIGN NO. 10.

DRAWINGS.—The seven plates illustrating this Design show readily the manner of construction, and in some of the details will need no explanation in words.

DIMENSIONS.—The *vestibule* (*a*) in Fig. 34 is 9 ft. wide, and the same in Fig. 35. *Sunday-school room* (*b*) in Fig. 34 is 52 ft. by 57 ft., 12 ft. ceiling. *Lecture or class room* (*c*) 20 ft. by 30 ft., 12 ft. ceiling. *Pastor's study* (*e*) 14 ft. by 16 ft. *Lobby* (*d*) 5 ft. wide, and *passage* (*f*) 4 ft. wide. *Closet* (*g*) 5 ft. by 9 ft. *Coal-room* (*h*) 5 ft. by 6 ft. *Water-closets* (*ii*) 4 ft. by 4 ft. 4 in. *Room for stair-way* to pulpit 7 ft. by 9 ft. Full size of rear projection is 9 ft. by 27 ft. 6 in. *Auditorium* (*b*, in Fig. 35) is 52 ft. by 78 ft., 22 ft. high at the walls, and 32 ft. at the apex of the ceiling. *Opening of recess* as seen from auditorium 17 ft. wide, and 12 ft. to spring-line of the Gothic heads, the two outer heads having the radius one-half that of the middle one.

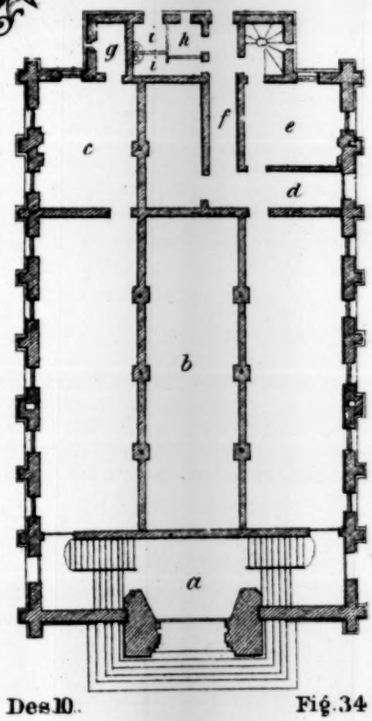
BRICK-WORK.—The *excavation* for the foundation is done by the mason, the loose dirt being removed outside the main walls, and, for protection to the walls, it is replaced against them as soon as they are high enough to receive it. He is also to excavate *vault* for water-closet 20 ft. deep, and wall up the same with whole bricks, the wall being one-half brick thick, and the vault 4 ft. diameter in the clear. The partition wall between *ii* and *g* is arched over the vault. *Outside foundations* 2 ft. below the surface of the ground, 27 in. thick, with 13 in. footings, raising the first joists 1 ft. from the ground. The three *cross*,

* See page 29.

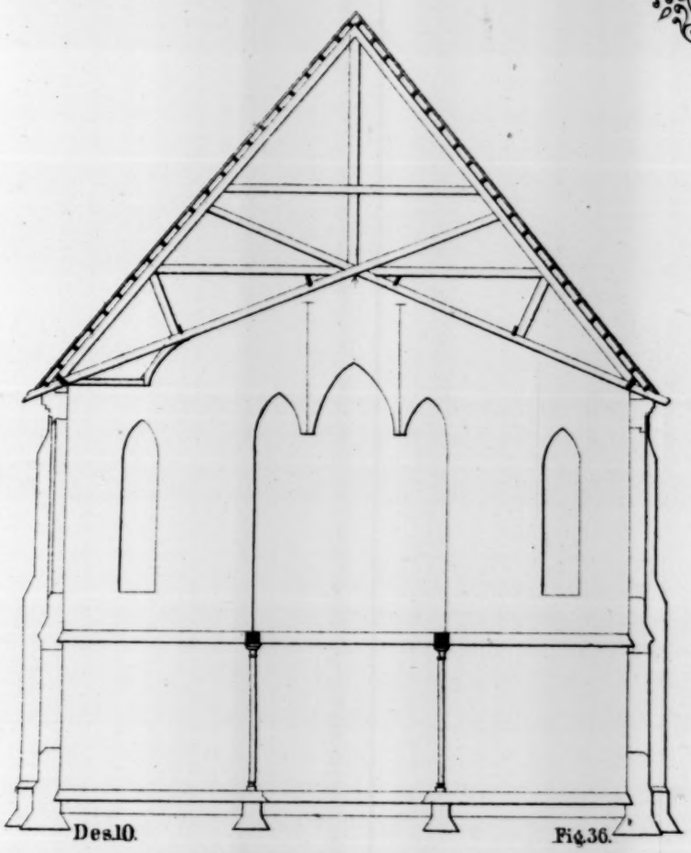
or *partition*, *walls* of foundation 18 in., with 9 in. footings. *Other* walls of the foundation, including the two dwarf walls for first joists, are 13 in. thick, with 9 in. footings. The *foundation* for the *iron columns* supporting the second joists consists of *piers*, built in the dwarf walls, 18 in. square, with 13 in. footings, and running to the floor to receive the base of the column. *Foundation of tower* 12 ft. by 24 ft., built up solid to the surface of the ground, with 18 in. footings. At the ground the door-opening drops off to a 27 in. wall extending up to the floor and receiving a *stone step*, or *door-sill*, 5 in. thick, and 14 in. wide. *Cast-iron gratings* (rat-proof) for ventilation, 1 ft. by 3 ft., are set in the foundation walls, one under each side window. *Stone sills* provided for all windows and outside doors, 5 in. thick. *Outer walls* of *first story* 22 in. thick; *cross walls* (three) 13 in.; *other partition walls* 9 in. *Outer walls* of *projection* in the rear 18 in. *Walls* of *second story* 18 in. thick; under the *gallery* 13 in.; *recess* in rear 13 in. *Tower* built up of brick-work to the top, as shown in plans. *Buttresses* are 18 in. square in first story, and 9 in. by 18 in. in second story. *Offsets* in tower and buttresses covered with stone caps. Tower, front wall, and return of first bay on each side, are built of well-selected *hand-pressed brick* and *white mortar* on the outside. Front wall is disconnected in bond from the tower, so that the settling of the tower may not affect the wall. *Bond-timber* 2 in. by 4 in., one course to each story, is worked in the walls immediately above the windows, making two secure ties all around the building. The *arches* in the wall over the pulpit-recess are built as shown in Fig. 36., supported by 1½ in. iron rods, 12 ft. to spring of arch, each arch has four courses (18 in.) of brick, with one main arch of four courses covering together the three smaller arches. *Flues* constructed as shown by plans; *chimneys* 8 ft. high, of ornamental finish. *Hood moldings* and ornamental finish of belfry gable are of terra cotta work. From immediately above the arches of the middle front window the tower is open inside (2 ft. 6 in. by 8 ft.) to the top, through which opening run four 1½ in. iron rods with screws and nuts, one at each corner, fastening securely the upper part of the tower to timbers 4 in. by 8 in., inserted 1 ft. above where the opening begins. Fig. 33 shows side elevation of belfry, but the wall of the belfry should show outside of the columns—that is, show the same thickness (5 ft.) as the lower part of this figure.* The belfry is covered with galvanized iron, and finished as shown by plans. All walls are carried up perfectly true and square, and exterior left clean and free from all defects. All arches guaged and finished in a workmanlike manner. All material of the very best quality.

Wood-work.—*Joists of first floor* 2 in. by 12 in., 18 in. from centers, two courses of bridging to each tier. *Joists of vestibules*, gallery, and small rooms in the rear 2 in. by 10 in., 18 in. from centers. No floor in coal-room (*h*). Construction and arrangement of vestibules, main stair-ways, and gallery same as in Des. No. 9., Fig. 30, as shown on the left side of that Fig., except that the platform here takes the place of winders there in the stair-ways. *Joists of auditorium* 2 in. by 14 in., 16 in. from centers, two courses of bridging 2 in. by 2 in. stuff to each tier, outer ends of joists project 8 in. into wall, and are nailed to the first course of bond-timber imbedded in the wall. The other ends, and both ends of the middle tier, jogged into the *girders*, flush at top, but dropping 2 in. lower at

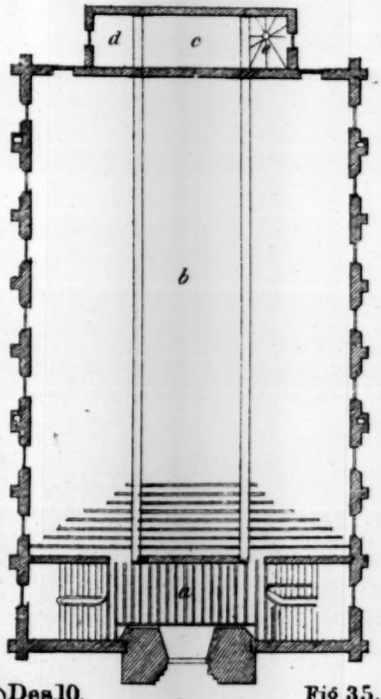
* These lines were omitted in lithographing.



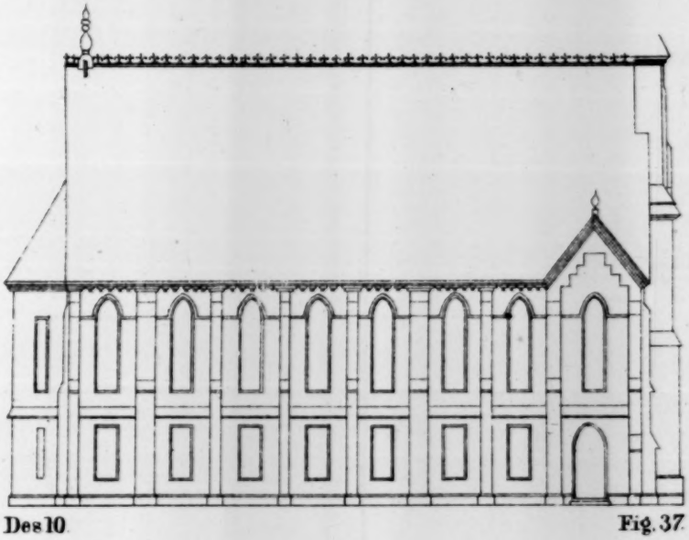
Des 10. Fig. 34.



Des 10. Fig. 36.



Des 10. Fig. 35.



Des 10. Fig. 37.

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bottom to receive a 2 in. by 2 in. tie, 2 ft. long, nailed to the under side of the girders and to the joists on each side of them, making a tie across the building, and throwing off the plastering from the face of the solid girder in the ceiling of the first story. The *girders* (Fig. 35) are 8 in. by 12 in., 2 ft. ship-laps, the laps coming on a column or wall. In the rear, the girders anchor into the wall; in front, they anchor into the tower by two joists of vestibule spiked to the sides of each, with other ends anchored 2 ft. into the tower. All joists and frames are built in as the brick-work progresses. *Wooden bricks*, well seasoned, are also worked into jambs to secure frames and casings.

IRON-WORK.—*Cast-iron columns* supporting girders are 7 in. in diameter at bottom, and 6 in. at top, metal $\frac{3}{4}$ in. thick, foot-plate 15 in. square, with socket to receive the column, molded cap with square head 9 in. square. Other irons as specified throughout the work.

DOORS.—*Front entrance* is 8 ft. wide, and 9 ft. to spring of arch; *frame* $2\frac{1}{2}$ in. thick, 12 in. wide, chamfered and rebated; *door* is double, 2 in. thick, rebated, of two thicknesses, outside framed and paneled as shown by plans, raised moldings, inside of narrow tongued-and-grooved boards, beaded edges; *strap-hinges* 2 ft. long, *mortise-lock* of best quality, porcelain knobs, heavy top and bottom *bolts*. *Side entrances* to vestibule and to the lobby in the rear 4 ft. 6 in. wide by 8 ft. to spring of arch, Gothic transoms; *frames* 2 in. thick and 12 in. wide, chamfered and rebated; *door* $1\frac{3}{4}$ in. thick, double, paneled, hung with 5 in. *butts*, good *locks*, and top and bottom *bolts*. Two *front entrances to Sunday-school room* 4 ft. by 7 ft., with 18 in. transom; *doors* double, $1\frac{1}{2}$ in. thick, paneled, hung with 4 in. *butts*, good *locks* and *bolts*. Other two doors to Sunday-school room 3 ft. 6 in. by 7 ft., with 18 in. transoms. All other doors of first story 3 ft. by 7 ft., with 18 in. transoms. Two entrances to auditorium 4 ft. 6 in. by 7 ft., double, paneled, shut by wire springs.

WINDOWS.—*Windows of first story* 3 ft. by 8 ft., boxed *frames; sash* $1\frac{1}{2}$ in. thick, $2\frac{1}{2}$ in. plain mullion, 8 lights, hung with weight and cord; jambs splayed, plaster finish inside, 1 in. round bead covering joint of plaster with the frame, sill $2\frac{1}{2}$ in. thick, slanting 2 in. inward, projecting 2 in. inside of plastering, and 2 in. beyond corners of splayed jambs at the ends. Two *closet windows* 1 ft. wide by 7 ft. high. Three *front windows* have molded jambs and mullions, solid frames rebated to receive stained glass; frames have tracery, with caps properly cut, as set forth in the plans. *Front window* in tower 6 ft. wide by 8 ft. to spring of arch; other *two front windows* 4 ft. by 12 ft. to spring of arch. *Side windows* 3 ft. by 12 ft. to spring of arch; *frames* boxed; *sash* $1\frac{1}{2}$ in. thick, mullion $2\frac{1}{2}$ in. in middle, forming kite-head at top, muntins $2\frac{1}{2}$ in. from stiles and mullions, *stained glass* of approved style and pattern, hung complete. (See Fig. 38.) Stained glass to transoms of front entrances. Two *windows in recess* in rear of pulpit 2 ft. wide by 9 ft. high, box frames, plain glass, sash hung with cord and weight.

ROOF.—The *roof* consists of nine *trusses*, or "*bents*," set over the buttresses. Each truss is carefully and thoroughly framed, joints close and true, fitted together in the very best workmanlike manner, the very best materials, lumber well seasoned and sound. *Rafters* 6 in. by 10 in., *straining pieces* 6 in. by 9 in., *collar-beams* 6 in. by 8 in., *purlins* 2 in. by 8 in., *wall plate* 4 in. by 10 in. The *construction* of the roof is shown in Fig. 36, the main timbers consisting of three pieces 2 in. thick, spiked together with 40-penny nails, and bolted with $\frac{3}{4}$ in. iron bolts at intersections and laps. *King-post* of

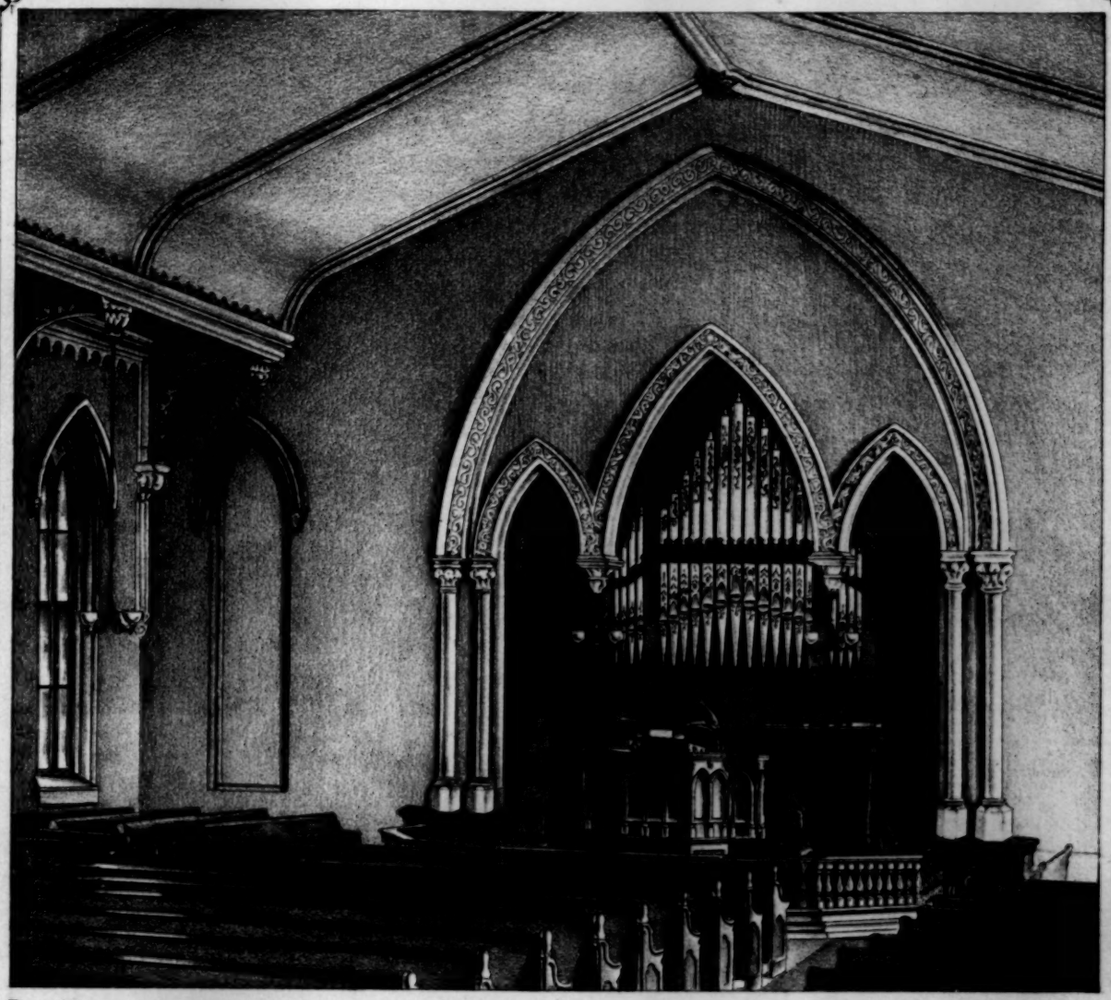
two pieces 2 in. by 8 in., strapped and bolted each side of truss. Foot of rafter is secured to straining pieces by iron straps ½ in. by 2½ in. (best quality of iron), with plate, washers, nuts, and bolts to secure the same, the middle 2 in. thickness of rafter passing through straining piece, other pieces footed down on straining piece. Head of straining piece secured to rafter by similar straps 3 ft. long, with bolts ¾ in. thick, the middle 2 in. thickness of the straining piece passing through the rafter as a tenon. Similar straps and bolts to king-post and collar-beams. The foot of each truss is jogged down on plate 1 in., and secured to it by 1 in. iron rod anchored two feet down in the wall. Four *ties* 2 in. by 8 in. running lengthwise of building, jogged on straining pieces, and lapped, and spiked together at intersections. *Ceiling-joists* 2 in. by 6 in., 2 ft. apart, flush with lower edge of straining pieces, resting on strip 2 in. by 2 in., nailed to straining pieces. Horizontal projection from wall is 8 ft., of 2 in. by 6 in. stuff, making the curve in ceiling as shown in plan, one end on plate, other spiked to truss. Sheath close with 1 in. boards, and cover with slate, or tin. Guttering 12 in., outside of wall, four 5 in. down pipes, elbows 12 in. from ground.

Lighting.—*Gas pipes* are put in to afford five drop-lights, with two burners each, in the Sunday-school room; one similar in class-room; a single light each in study and lobby; two double brackets in each vestibule; auditorium, as shown in Fig. 38—twelve pendants with three burners each, four lights at the pulpit, and four in the gallery.

Heating.—Two large furnaces, made by Mr. Lotz, of Cincinnati, are placed in the Sunday-school room, near the flues, and with hot-air pipes warm the auditorium. A grate is in the study, and also in the class-room; or a stove may be used in the latter, say the "Meteor," from J. S. Lithgow's, Louisville.

Inside Finish.—*Door casings* 6 in., with 3½ in. moldings. The front of *gallery* projects 3 ft. into auditorium, finishes with narrow upright Gothic-headed panels, 2 ft. 6 in. high, with cap 2 in. by 6 in., and base 8 in., with 3 in. molding at bottom, projecting below to cover the plastering. *Base-board* throughout the building 8 in., with 4 in. molding. *Altar*, *platform*, and *pulpit*, as shown in Fig. 38, of yellow pine, ash, or maple, with walnut trimming. Floor inside of altar raised 8 in. A wall of 2 in. by 6 in. studs reduces pulpit recess in width, having on each side a door with Gothic transom, one opening to stair-way from study, and the other into a small room on the other side. If an organ is not placed in this recess the wall may run across the back, lessening depth of recess, giving a 3 ft. passage between that and main wall. In this case a triple-headed Gothic window, set in the middle of the back wall of the recess, will make a beautiful finish.

Stair-ways.—*Steps* are required in vestibule next to front wall, in rising from level of Sunday-school room to the floor level with front entrance, Fig. 34. A *main stair-way* on each side of front entrance, beginning as shown in Fig. 34, leading to upper vestibule, is 4 ft. 6 in. wide; platform against end walls of vestibule, carriages (three to each) 2 in. by 14 in., well secured, steps 12 in., and 1½ in. thick, risers 7 in., rail 4½ in., newel posts 8 in. square, stair-way closed up to rail with Gothic-headed panels, as in pulpit (Fig. 38); *stair-way to gallery* 2 ft. 6 in. wide, closed up to ceiling with narrow beaded boards, door paneled, with lock to prevent occupying gallery when desired. Stair-way from study to pulpit recess is 2 ft. 6 in. wide.



Des 10. Fig. 38.

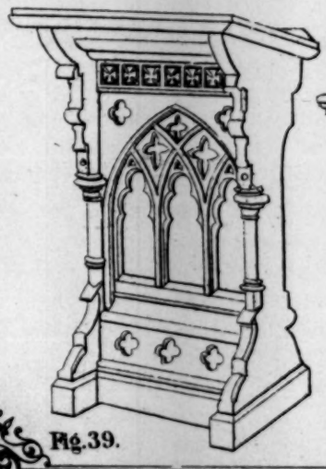


Fig. 39.

Fig. 40.

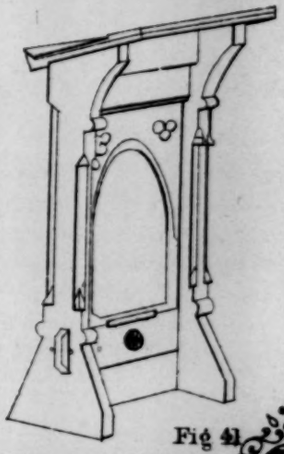


Fig. 41.

Strobridge & Co. Lith. Cin.

PLASTERING.—The *plastering* is three-coat work, of best quality, throughout—that in first story has sand finish; Sunday-school room has a 12 in. plaster Paris molding at intersection of wall and ceiling, and an ornamental center at each of the drop-lights 4 ft. across. Second story has a light brown, or gray, coat of rich brown mortar on walls, carefully floated up, lines straight, and angles true. Ceiling is of lighter gray, finishing-coat made of lime and clean white sand, well floated up. Walls and ceiling to be free from streaks, spots, or other imperfections. The ornamental work in plaster Paris is clearly shown in Fig. 38—jambs and hoods of windows, arches to pulpit-recess, bosses, corbels, spandrils, ridge, rib, and other molding and ornamentation. Special frame-work, carefully made, is required for all large moldings, in order to make the plaster-work sufficiently light, and *perfectly secure* from falling. All done in the very best workmanlike manner.

PAINTING.—All painting three-coat work of white lead and oil. *Base* of light-brown color, darker than the brown walls; *doors* and casings grained oak and walnut; *stair-ways*, *gallery*, *altar*, *platform*, and *pulpit* of natural walnut, with oak, ash, or maple panels, three coats of varnish; or these grained to represent these colors, and finished with good coat of varnish; *sash* white; all wood, tin, and galvanized iron, outside, painted light gray.

FINALLY.—The building is throughout a *first-class* job, both as to materials and workmanship.

PARSONAGES.

Des. 1. Fig. 42.

PARSONAGES.

By the Rev. Bishop W. M. Wightman, D.D., LL.D.

MINISTERIAL residences form a part of the *structural* agencies of the Church; they play, indeed, a most important part in the working scheme of Methodism. The prominent feature of this system of ministerial operations ever has been, and for generations to come will continue to be, *itinerant*. In the calm judgment of the laity and ministry of the Church, itinerancy—the periodical, regularly-occurring change of the preachers—has utilized talent, prevented stagnation, strengthened Connectional bonds, and been amazingly effective as a means of religious progress. In the face of the self-sacrifice it of necessity occasions, this form of evangelical operations is looked to as the foremost element in the practical applications of that mighty preaching force which shall form Christian societies, and erect churches, from one side of the North American Continent to the other.

This peculiarity of our ministerial institute makes parsonages an emphatic, pronounced necessity. The preachers are, for the most part, married men. At the session of an Annual Conference they accept the appointments in the spirit of a noble trust in God, in the confidence that the arrangements made for their distribution are judicious, and have been the result of prayerful deliberation; and that the pastoral charges to which they are sent will receive them as embassadors for Christ. Thus it happens that a good man, with his wife and children, after a break-up and a move of many miles, reaches his circuit or station. Among his first inquiries will naturally be this, "Where is the preacher's home?" He is directed to an eligibly located and comfortably furnished PARSONAGE. That is his

house and home for the year. If, as is often the case, his arrival is expected, and a committee of ladies has had in hand the arrangement of affairs, and a cordial greeting, a warm supper, and a well-supplied pantry await the new pastor and his family, why, everybody knows how he must feel, and how he will interpret this as an omen and earnest of a happy, successful year, and how hopefully and gladly he will go into his work. On the other hand, suppose he is met with the information that there is no preacher's house on the circuit—suppose, as has been the case more than once or twice in the sad experience of traveling preachers, no boarding-house can be found, no residence can be rented, stewards make promises, but do nothing—suffering, and heart-agony, and temptation to give up the work of the ministry ensue. The faith which carries an itinerant Methodist minister along such a path of trial and suffering, "faint yet pursuing," is as heroic as the faith of martyrs and confessors. The patient endurance of hardships on the part of the noble women who are the wives of these men would illustrate the brightest page of the Church's history.

It is plain: We must have parsonages; we shall have them. They are already plentiful in some parts of the Connection; every year sees them multiplying. Large circuits, which forty years ago had no preacher's house, now are divided into six, eight, and ten compact circuits, with a parsonage on each. This is an evidence of permanence as well as progress; it shows a growing appreciation, on the part of the members of the Church, of the faithful endeavors of the ministry to promote their spiritual and eternal welfare; it indicates their desire that the amount raised for the maintenance of the minister and his family—rarely respectable, often not comfortable—should not be in part expended in renting a habitation to shelter him; it is a practical demonstration of the felt importance and value of an efficient itinerant ministry.

This brings us to the question, Where shall the parsonage, if one is to be built, be located?

The answer to this question is plain: The location, as far as it is practicable, should be central, in reference to the preacher's field of labor; healthy, and convenient to school and church; and, if in the country, it should invariably be in the neighborhood of pleasant, kind families. It should be accessible to the people of the pastor's charge; otherwise, they will fail to feel the proper interest in the home of the preacher. It will greatly diminish a pastor's labor, and also afford his flock in times of trouble easy access to his door, if the parsonage is located at the right center. From this center lines of sympathizing interest should run out to all the homes of his parishioners, to bring back to the bosom of his family their affectionate regards. In cities, a healthy and pleasant street should be selected, not too remote, of course, from the church served by the pastor. Wherever a circuit parsonage can be placed at a village convenient to the circuit, this will secure protection to a preacher's family during his necessary absences, besides furnishing social and educational advantages for them. A proper location of the preacher's house repays a hundred-fold what it may cost.

But the right place has been found for the parsonage: what sort of house shall be built?

This question must be answered, generally, in view of the means at command for the purpose. If these are barely sufficient to put up the smallest and cheapest house that can

be made to answer the purpose, why, then, there is little use of saying any thing. But supposing that the amount in the hands of the building committee is sufficient to erect a comfortable and decent house, then, while it is true that the construction of a parsonage should differ in no material respects from that of any other comfortable dwelling, yet several suggestions are worthy of consideration.

1. The style of the building should be in keeping with the character of the church which it represents. A costly and ornamented house would be as much out of place in rural districts among a people in humble circumstances, as an unsightly "shanty" would be, if forced into service as the residence of a pastor of an influential city church. The parsonage, as well as the church-edifice, is a *representative* building; its style either adds to or detracts from the respect due the religious communion it represents. To place a minister in a small, cheap, inconvenient building, far below the style of houses occupied by ministers of other churches in a community, implies that your denomination lies in a different social position, much below theirs. Obviously, something is due to self-respect in this matter. A Christian communion should aim, in the erection of its parsonage, to make it stand before the public eye as the symbol of the loving care and affectionate respect of a flock toward its pastor. The preacher's home should be such that no member of the church would be ashamed to carry a visitor to its door.

2. The arrangement, size, and number of rooms, should be in keeping with comfort, utility, and economy. If in the country, it may be a one-story building, with a wide hall running through it, giving access to four rooms. Let this hall then be carried into the rear of the house, so as to form a piazza, opening into a dining-room and a cooking apartment. In a town or city station, where land is dearer, the house should be a two-story dwelling. The hall may run on one side of the building, opening into two rooms below, and, by a staircase, leading to two similar rooms above. This will leave room at the head of the upper hall for a small apartment, which can readily be warmed in cold weather by a small stove. In warm weather the draught between the front window and the open door will give good ventilation. This suite of rooms will not be sufficient: another family-room must be provided, besides a dining-room and cooking-room. This is accomplished by a piazza of the breadth of the hall and prolonging it, giving access to three additional rooms, which are of one story, joining the end of the house.

3. In planning a preacher's house, one point must never be overlooked: the parsonage demands, and must have, a *study*. This ought to be a comfortable room, summer and winter, with good light and plenty of air—out of the way of visitors and the play-noises of children. There must be, of course, a drawing-room for the reception of company, for there will be constant calls, of one sort or another, at the parsonage; but it is manifest you cannot make a *study* out of a room given up to visitors. It is equally plain that the family sitting-room will not answer. In the plan of the house last sketched, the small apartment at the front end of the upper hall meets fully the conditions of the case; it will be large enough to hold an ordinary-sized library, with a writing-desk; it will be cozy, and provocative of good, steady, intellectual work. In the sketch of the country parsonage, just given, the main deficiency is found in the want of a suitable room for a study, unless one of the front rooms might be so used; and, furnished with a bed, be used also as

an occasional bed-room, when "company" is to be entertained. But let it be repeated, with emphasis, There must be a study in every parsonage! and woe to the preacher who has one, and does not use it! A few really first-rate books, by the great masters of theological style and thought, well and thoroughly studied, are worth more to a minister than the Bodleian library, used only for miscellaneous reading.

4. The change in the circumstances of the Southern people since the late war makes necessary various changes in the economic and servile conditions of former times. The kitchen must now, in all newly-constructed houses, be attached to the family residence. The wood or coal shed must join the kitchen. An ample cistern should be located so as to supply the house with water without the necessity of going into the yard—if under the house, all the better; or if the supply comes from a well, it should be as close to the kitchen as possible. That apartment should always be furnished with a waste-pipe. One of Lithgow's stoves—to mention the best we are acquainted with—size to correspond with the size of the family, should occupy the cook-room. The labor-saving improvements of the present time, so far as the laundry is concerned, may be introduced with advantage. A clergyman's nursery is generally supposed to be, in point of size, in the inverse ratio of his pantry. But a pantry, large or small, must of course be provided; it ought to lie adjacent to the dining-room. No particular mention need be made as to the necessary heavy furniture of such a dwelling.

5. A vegetable garden is a necessity as a pendant to a country parsonage. In a city parsonage, where there is not generally ground enough for this, a few ornamental trees, a grass-plot, a small bed or two of flowers, or a dozen pots of geraniums, on the front piazza, will change and beautify the whole aspect of the house. A single grape-vine, tastefully trained, is worth, for esthetic ends, ten times the amount of fruit that may grow upon it. God made the flowers, and gave us the sense of the beautiful. Why should we grudge the little time and attention necessary to invest our homes with the charm of nature's beautiful things, which may minister the purest satisfactions to wife and daughters, and cheer the weary spirit amidst the fluctuations and inevitable discomforts that belong to an itinerant life?

6. Each station and circuit should own a parsonage. To rent is precarious, is exhausting, and prevents improvement. Trustees should be appointed, titles secured, and the building kept insured. In every public building of the sort should be found one of Gardner's fire-extinguishers. It would be well for the stewards, in making an appropriation for the preacher in charge, at the commencement of the year, to estimate, also, the amount necessary to keep the parsonage in repair, and to assist in furnishing it. Parsonage societies have been very advantageously formed among the ladies for this purpose; and many parsonages have been handsomely furnished in this way. There should be some systematic plan of operations looking to this important end. If left to chance-benevolence, the house will soon present a weather-beaten front, grounds and fences will be neglected, furniture become shabby, crockery dilapidated, and the preacher's home lose whatever attractions or comforts it may once have possessed.

7. Let this word, *ad clerum*, be added: In occupying the parsonage, the minister and his family should never be indifferent to the important interest the Church holds in prop-

erty of this sort, acquired and kept for the benefit of those who serve at her altars. The parsonage should always be occupied. Conscientious and scrupulous care should be taken of the premises. The furniture should be kept in order. Every incumbent should aim at leaving the premises to his successor in better condition than he found them. His interest in the property, thus manifested, will be sure to increase the interest and good feeling of the station or circuit. After all, the preacher creates his own parsonage, in a very substantial sense. The people whom he serves faithfully are very apt to be pleased, and are ready to assist when they see him thoughtful for the comfort of his family, and disposed to arrange things at home neatly, to beautify and improve his PARSONAGE.

DESIGNS FOR PARSONAGES.

BISHOP WIGHTMAN, in his article on "Parsonages," has fully, clearly, and forcibly presented this important subject. The duties of his office have acquainted him with the wide-spread demand for preachers' homes, and also with the fact that the demand is far in excess of the supply; hence his urgent and timely plea for more parsonages, and better ones. He shows us that he is either himself a close observer of household affairs—knowing what makes a convenient and comfortable *home*—or else has the counsel of another, who is altogether familiar with such things. We are disposed to think both propositions true: accordingly, acknowledgments are due to both the Bishop and his estimable wife for the very excellent suggestions on the subject, as set forth in the article, and also given to us personally. Nothing remains but to give the Designs and Specifications for houses adapted to their intended use, and within the limit of the means with which they are required to be built.

DESIGN NO. 1.

ONE-STORY FRAME HOUSE.

THIS Design is intended for a cheap country parsonage. While it is simple in style and economical in arrangement, the rooms are sufficiently large and convenient to be pleasant to the occupants.

The lot ought to contain at least eight or ten acres of ground, in order to accommodate all the wants of the family. This will afford a yard of ordinary size, to be used for nothing else, stable, lot, and pasture for horse and cow, and a garden sufficient to produce all the vegetables the family may desire. The garden-spot may also contain a few choice

fruit-trees, which will abundantly repay the expense and trouble of growing.* Trees, grass, and flowers should also beautify the yard, being protected from abuse by stock. All out-houses should be substantial and comfortable—the horse, cow, pigs, and chickens all having their respective shelters. The location of the dwelling should be on some high point, generally the highest point on the lot, as convenient as practicable to good water.

When necessary or desirable, a portion of the house can be built, leaving the other to be added afterward. The front rooms and hall may be put up first, adding first the three rooms back of these, and then the others, with the porch. The entire building can be put up at a cost of $1,000 or $1,200.

SPECIFICATIONS FOR DESIGN NO. 1.

Fig. 42 is the front elevation, and Fig. 50 the ground-plan.

Dimensions.—The *front porch* (*a*) is 6 ft. wide by 34 ft. long; *front hall* (*b*) 7 ft. wide, 16 ft. long; *parlor*, or *sitting-room* (*c*), 16 ft. by 17 ft., 12 ft. ceiling, may have a bed in it, and serve as "company" room, has a grate, or fire-place, and closet; *family-room* (*d*) 16 ft. by 17 ft., 12 ft. ceiling, with grate, or fire-place, and closet; *nursery* (*f*) 12 ft. by 14 ft., 9 ft. ceiling, with stove and closet, opening into family-room; *e*, just back of front hall, is 12 ft. by 13 ft., has a flue for stove, and also a closet, may be used for a *dining-room; g* is the *study*, or "*library*," 12 ft. by 14 ft., 9 ft. ceiling, with flue for stove. The rear building consists of two rooms (*k*) 10 ft. by 12 ft., 10 ft. ceiling, for *kitchen*, and *l*, 10 ft. by 10 ft., 10 ft. ceiling, for *servants'-room;* or *k* can be used as dining-room, and *l* for kitchen. These rooms are separated from main house by an open hall, or porch (*h*), 4 ft. wide, extending back at the side (*i*) 5 ft. wide, at the end of which is a pantry 6 ft. by 7 ft. In the kitchen (*k*) is a flue for stove, a closet, wash-basin, and sink.

Brick-work.—The *foundation piers* are of well-burned brick, 9 in. by 18 in., returned at corners, 18 in. under ground, with 9 in. footings, extending above the general level 2 ft. *Piers to porches* 9 in. by 13 in., 12 in. under ground, 6 in. footings. *Flues* 9 in. opening, running 4 ft. above the roof, thoroughly pargetted. *Chimneys* built as shown by plans.

* Fruits which Everybody can Grow.—We might, perhaps, place under this head most of the species adapted to our climate, but some of them require more attention than others, and more than the aforesaid "everybody" may be willing to give them. Nothing worth having can, as a rule, be had without some labor or expense, and no good fruit-bearing trees or plants will take care of themselves altogether; but we will name a few things which require so little skill, attention, or labor that any one, who deserves to have any thing better than "hog-plums" and haw-berries on his table, will be willing to give them the small amount of care they demand. 1. Strawberries, selecting such varieties as Wilson's Albany, Longworth's Prolific, and Nunan's Prolific, can be had in abundance for home use with a trifling outlay of labor. 2. The black cap raspberries, planted alongside the garden-fence, where they will be shaded during a part of the day, do well with little attention. 3. Figs, such as Brown Turkey, Brunswick, Black Ischia, and Celestial (sugar fig), require little but the planting, and never fail. 4. Scuppernong grapes, and other varieties of the Southern muscadine species, do not tax our care much, and repay us largely. 5. The wild goose plum, and other kinds of the Chickasaw type, ask but little and give much. 6. Peaches will flourish in the fence-corners and old fields, but will repay some attention. 7. Where the soil suits them, and the borer is not too destructive, apples of native varieties are grown with only a moderate degree of attention. Those who will not take the trouble to have these fruits deserve nothing better than "hog and hominy," year in and year out.—*Christian Advocate.*

WOOD-WORK.—*Sills* to main building 6 in. by 10 in.; for other rooms 4 in. by 10 in. *Joists* for two front rooms and hall 2 in. by 12 in., 2 ft. apart, one course of cross-bridging; joists for other floors 2 in. by 10 in., 2 ft. apart, all well framed into sills. *Ceiling-joists* 2 in. by 6 in., 2 ft. apart, securely nailed on top of plates. *Studs* 2 in. by 4 in., at corners, doors, and windows 4 in. by 4 in., nailed at top and bottom; partition walls supported by double joists. *Braces* 2 in. by 4 in., let into studs, and nailed at head and foot to posts and sills, and to posts and plates. *Plates* 4 in. by 4 in., of two pieces 2 in. by 4 in., spiked down on to studs. *Rafters* 2 in. by 5 in., 2 ft. apart, secured at top to ridge-piece 1 in. by 6 in., and notched down 2 in. on plates by the side of joists, nailed to joists and plates. *Collar-beams* 2 in. by 4 in., spiked to rafter half way up. *Weather-boarding* 6 in. wide, dressed, 4½ in. exposed, lines straight, and joints close. *Sheathing* for roof 1 in. boards, covered with *shingles* 16 in. long, 5 in. to weather, of white pine or heart cypress. Edge of shingles showing in gables dressed to a straight line, and project 1½ in. over crown-molding. *Cornice* of main building 18 in. at sides and ends; of rear building 12 in. The three rooms (*e*, *f*, *g*) have a "shed" roof, or lean-to roof, heading immediately under the cornice of main roof. *Finish* of the front is shown in plans.

DOORS.—*Front door* is 3 ft. 6 in. by 7 ft., with 14 in. *transom*. *Other doors* 3 ft. by 7 ft., paneled, hung with 4 in. loose-joint butts, and provided with good locks. *Door-casings* 5 in. wide outside, and 6 in. inside. *Closet doors* 2 ft. 6 in. by 6 ft. 6 in.

WINDOWS.—*Main windows* (four) 3 ft. by 7 ft., 2 ft. from floor; *other windows* 2 ft. 10½ in. by 6 ft. 6½ in., twelve lights 10 in. by 18 in.; *casings* same as doors; *sash* 1⅜ in. thick, all hung with weights.

The *floor* is of narrow dressed boards, tongued-and-grooved. *Base* is 12 in., with 2 in. molding cut on upper edge of the board, and quarter-round at bottom. *Wash-basin* and *sink* in kitchen (*k*) are 2 ft. high, consisting of a close box 6 in. deep, bottom slanting 1 in. toward the sink, with 1 in. hole opening into sink; the *sink* is about 18 in. square, with funnel connecting with pipe below to carry off the water.

PLASTERING.—*Ceilings* are two-coat work, and walls three-coat, last coat hard white finish. In *j*, *k*, *l* is two-coat work, both brown, second coat well troweled. *Closets* have two-coat work.

PAINTING.—Body of the house light gray, with white trimmings; or a house of this size will look well painted white, doors oak color, inside white, all three-coat work.

DESIGN NO. 2.

ONE-AND-A-HALF-STORY FRAME HOUSE.

THIS Design was referred to in Church Des. No. 1, which may be converted into a parsonage, as shown in Figs. 42, 43, and 44, the rooms *j*, *k*, *l*, *m* being added to the original building. The Design may also be executed as a new building. It will suit well for vil-

lage or suburban residence, or even for the city. Although of a cheap style of architecture, it presents a very neat appearance, and is quite convenient. This house has been built at a cost of $1,800.

SPECIFICATIONS FOR DESIGN NO. 2.

DIMENSIONS.—*Front porch* (*a*) 6 ft. wide by 24 ft. long; *vestibule*, or front hall (*b*), 5 ft. by 9 ft. 6 in.; *parlor* (*d*) 15 ft. by 17 ft.; *dining-room* (*e*) 11 ft. by 17 ft., with closet by the flue; *family-room* (*f*) 15 ft. 6 in. by 17 ft., with fire-place, or grate, and closet; *g* is a large *area*, or *hall*, 8 ft. 6 in. wide, and opening into the *back hall* (*j*), which is 5 ft. wide; *h* is a *pantry* 6 ft. 6 in. by 12 ft.; *nursery*, *dressing-room*, *bed-room*, or *library* (*i*), 11 ft. by 12 ft.; *ceiling* to all the foregoing rooms 12 ft. in the clear; *kitchen* (*k*) 12 ft. by 13 ft. 6 in., with flue for cooking-stove or range, and a wash-basin and sink; *servant's-room* (*l*) 11 ft. by 12 ft.; *bath-room* (*m*) 5 ft. by 8 ft.; the last three rooms have 9 ft. *ceiling*. In second story (Fig. 44) *a*, 4 ft. by 16 ft.; *b*, 12 ft. by 15 ft.; *c*, 4 ft. by 8 ft.; *d*, 12 ft. by 24 ft.

BRICK-WORK.—*Piers* as in Church Des. No. 1. *Flues* and *chimneys* as shown in plans. In the double chimney the flues for the second story run into flues from fire-place below, the chimney terminating at top with only two openings.

WOOD-WORK.—*Timbers* same as in Church Des. No. 1. (See Specifications for that Design.) The alterations to be made in the construction will readily appear; studs are set flush with sills. Partition walls are of 2 in. by 4 in. studs, doubled at the doors.

OUTSIDE FINISH.—*Base* 12 in. wide, dropped 1 in. below sills; *water-table* 1¾ in. by 2 in.; *corner facings* 12 in. wide, returned; *frieze* 18 in. wide; *cornice* 18 in. all around; door and window casings to main part of the building 4½ in. wide, 1½ in. thick. *Posts* of porch 6 in. by 6 in. at bottom, and 5 in. by 5 in. at top, chamfered as shown; *rail* 2 in. by 3½ in.; roof of porch framed for floor above, ceiled underneath with well-seasoned, dressed, tongued-and-grooved, double beaded boards; brackets to house 12 in. by 16 in., 2½ in. thick.

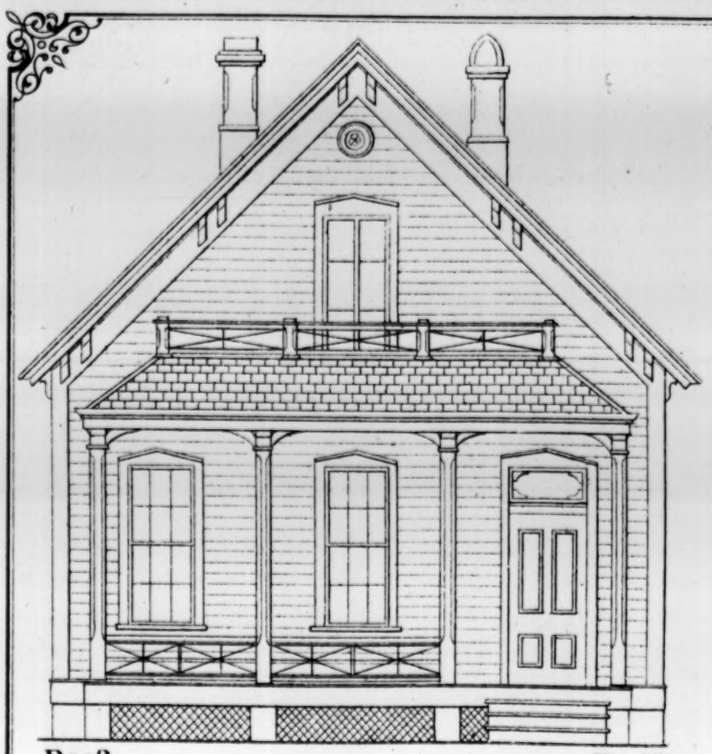
DOORS.—*Front door* 3 ft. 6 in. by 7 ft., with 18 in. transom; *all other doors* 3 ft. by 7 ft., with 18 in. transom for main building, and for rear rooms 2 ft. 8 in. by 6 ft. 8 in., with 14 in. transom; all paneled, good locks, butts, bolts, etc.

WINDOWS.—*All windows* have regular box frames, 2 ft. 10½ in. by 7 ft. 2½ in., those in rear rooms 2 ft. 10½ in. by 5 ft. 10½ in. *Sash* 12 light, hung complete; upper window hung on hinges to open.

INSIDE FINISH.—Base 7 in. wide, with molding (additional) 3 in.; *casings* 6 in., with 4 in. molding. Arrangement of stair-way, bath-room, wash-basin, etc., see plans; *fire-place*, or *grate*, in rooms *d* and *f*, *flues* for stoves in the other ones; *wooden mantel* of good pattern and style to each fire-place.

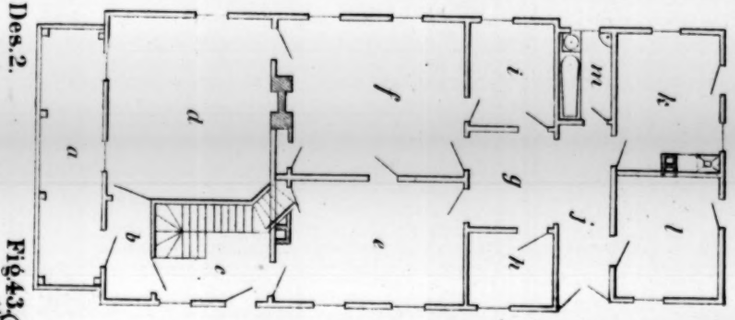
PLASTERING.—The *plastering* is a substantial two-coat work, white finish, executed in best workmanship, and of best materials.

PAINTING.—The *painting* is best two-coat work. Color inside white, except the base and stair-way, which are oak and walnut; outside, body color buff, trimmings white, or darker buff.

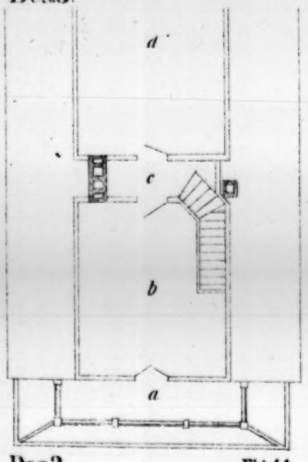


Des.2. Fig.42.

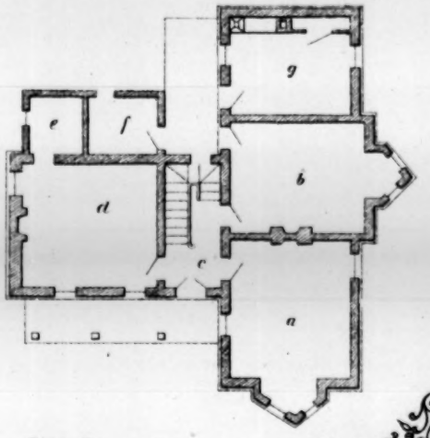
Des.3. Fig.45.



Des.2. Fig.43.



Des.2. Fig.44.



Des.3. Fig.46.

Stratridge & Co Lith. Cin.

DESIGN NO. 3.

ONE-AND-A-HALF-STORY BRICK HOUSE.

THE Design presented in Figs. 45 and 46 gives us a house more substantial in material and more beautiful in style, and also more expensive in construction, than the preceding ones. The same can be built of wood to excellent effect, and at less cost than brick. This house should have an ample yard, with forest-trees and evergreens, but not so numerous as to obscure the view of the house, or prevent the growth of grass and a few choice shrubs and flowers. The bay of the dining-room may be beautified with jars of ivy and other perennial growth. Non-flowering plants are considered more desirable in-doors, on account of promoting health more than the others.

SPECIFICATIONS FOR DESIGN NO. 3.

DIMENSIONS OF ROOMS.—In Fig. 46 *a* is the *parlor*, 15 ft. by 18 ft., with 12 ft. ceiling, bay 4 ft. deep, by 7 ft. wide; *dining-room* (*b*) 14 ft. by 16 ft., 12 ft. ceiling, bay 3 ft. 6 in. by 6 ft., may have a china closet next to the grate, and side-board, safe, etc., on the other side of the room; *hall* (*c*) 7 ft. by 16 ft., with stair-way; *d* is the *family-room* 16 ft. by 18 ft., 12 ft. ceiling, has fire-place, or grate, may have closet by fire-place; *dressing-room* (*e*) 6 ft. by 6 ft., 8 ft. ceiling, with door opening from family-room; *pantry*, or *store-room* (*f*), 6 ft. by 9 ft., 8 ft. ceiling; *front porch* 6 ft. by 25 ft., 11 ft. to ceiling; *back porch* 7 ft. by 16 ft., 9 ft. ceiling; *kitchen* (*g*) 12 ft. by 15 ft., 10 ft. ceiling, with flue for stove, or range, closet, and sink. *Second story* corresponds in size and arrangement of rooms with *a*, *b*, *c*, *d*, height of side walls 6 ft., ceiling 10 ft., a closet by each fire-place, an additional window in rear side of room over *b*. Rooms over *a* and *d* are bed-rooms, room over *b* is a study, or library. If necessary, another room may be added on the first floor to the rear of the kitchen (*g*).

BRICK-WORK.—*Foundation* 18 in. thick, 6 in. footings, 18 in. under ground, and 18 in. above; for *partitions* and *bays* 13 in., 6 in. footings; *chimneys* commencing with foundation. Main walls outside 13 in. thick for both stories. Walls between *a* and *b*, between *c* and *d*, and the walls of *e* and *f* and bays, are 9 in. thick. *Outside finish* of the work is shown by plans. Flues are finished off 5 ft. above roof.

WOOD-WORK.—*Joists* for first story 2 in. by 12 in., 2 ft. from centers, with one course of bridging to each set of joists; for second story, joists the same, 16 in. from centers, with two courses of *cross bridging; ceiling-joists* of second story 2 in. by 4 in., 2 ft. apart, serving also the place of *collar-beams*, spiked to rafters; *rafters* 2 in. by 4 in., 2 ft. apart, let down 2 in., and spiked on to *wall-plate*, which is 4 in. by 6 in.; *sheathing* 1 in. thick, laid close; roof of best shingles, or tin, carefully and securely put on. The *finish* of *porch*, *bay*, *brackets*, etc., shown in plans.

DOORS AND WINDOWS.—*Front door* 4 ft. by 6 ft. 8 in., 1½ in. thick, with Gothic *transom*,

shutters double, paneled, raised molding, good locks and butts, with ornamental finish; all *other doors* 3 ft. by 7 ft., with 18 in. transoms; *closet doors* 2 ft. 6 in. by 6 ft. 6 in. *Windows* of first story 3 ft. by 6 ft. to spring of arch; second story, *small windows* 2 ft. 6 in. by 5 ft. 6 in.; windows over bays 4 ft. by 5 ft. 8 in. to spring of arch; *sash* as shown in plans, 1½ in. thick, hung with cord and weight, in balloon frames.

INSIDE FINISH.—*Casings* to doors and windows, and to bays, 6 in. wide, with 3½ in. molding; *base* 8 in., with 4 in. molding; *flooring* of best quality, narrow, seasoned, dressed, tongued-and-grooved; *iron mantel* for each fire-place 4 ft. 6 in. high; *stair-way* of 12 in. *steps*, 3½ in. walnut *rail*, and 6 in. *newels*.

PLASTERING.—Regular three-coat work in main rooms in first story, finished white or tinted; and two-coat work on other rooms, white finish.

PAINTING.—All *wood-work* exposed to weather has three coats of oil-and-lead paints, such colors as may be selected; inside painted white, or other light color, three-coat work.

DESIGN NO. 4.

A TWO-STORY BRICK HOUSE.

A GREATER outlay in money is contemplated in this Design than in those already given. It is intended specially for large and wealthy charges, and suited for a parsonage in any of our cities. In Fig. 47 we have the front elevation of the Design, being the width of one room and hall, and corresponding with Figs. 48 and 49, leaving off the rooms *c* and *f*, and putting two windows instead of one in the front rooms (*b*, *b*). A house of this description can be built complete for $5,000 or $6,000. It may constitute a part of a larger building as in Des. No. 5, the other rooms being added afterward. For the size and cost of the house, a more convenient arrangement could scarcely be gotten up.

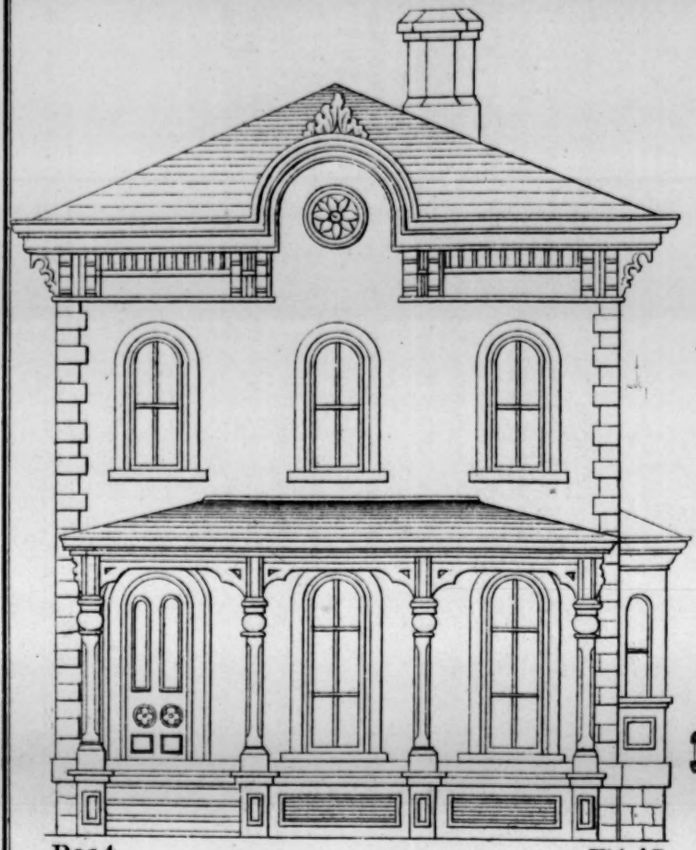
SPECIFICATIONS FOR DESIGN NO. 4.

DIMENSIONS OF ROOMS.—(The rooms *c* and *f* are not considered in this Design.)

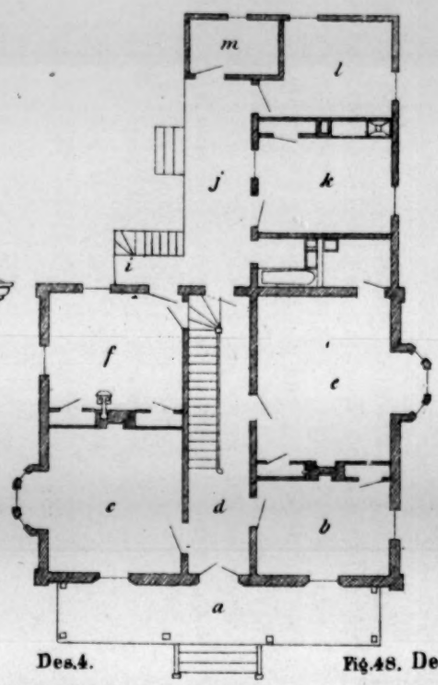
First story: The *porch* (*a*) is 6 ft. by 20 ft., 10 ft. to ceiling; *parlor* (*b*) 14 ft. by 16 ft., 12 ft. ceiling; *chamber*, or *family-room* (*e*), 16 ft. by 18 ft., 12 ft. ceiling, with *bay* 4 ft. by 7 ft., and *dressing-room* 5 ft. by 7 ft.; *bath-room* 5 ft. by 7 ft. 6 in.; *dining-room* (*k*) 14 ft. by 16 ft., 10 ft. ceiling; *piazza* (*j*) 7 ft. wide, 9 ft. ceiling; *kitchen* (*l*) 12 ft. by 13 ft., 10 ft. ceiling; *store-room* (*m*) 7 ft. by 9 ft.

Second story: Study, or *library* (*b*), 14 ft. by 16 ft., 11 ft. ceiling; *bed-room* (*e*) 14 ft. by 16 ft., 11 ft. ceiling, with *dressing-room* (*g*) 3 ft. 6 in. by 8 ft. 6 in.; *linen closet* (*h*) 3 ft. 6 in. by 7 ft.; the *hall* (*d*) 7 ft. wide.

BRICK-WORK.—*Foundation walls* of front or main part of the building (of stone, if it can be conveniently obtained, otherwise of brick) 18 in. thick, 9 in. footings, 18 in. under



Des.4. Fig.47.



Des.4. Fig.48. Des.4.

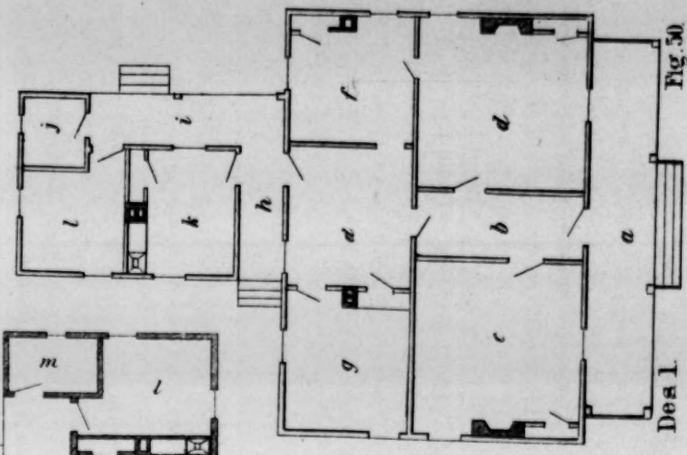


Fig.50 Des.1.

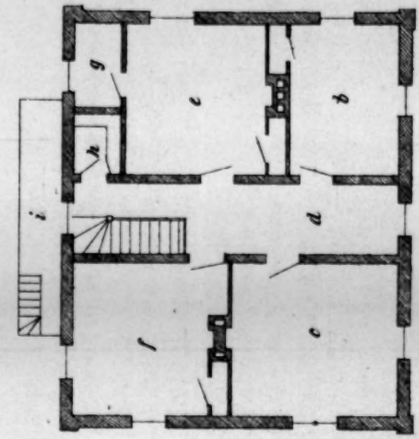


Fig.49.

Strobridge & Co. Lith. Cin.

ground, 18 in. above ground; for *rooms in rear*, hall, partition, and bay, 13 in. walls, 4 in. footings, same height as others; *piers* for porch and piazza 9 in. by 18 in.; *main walls* 13 in., with *stone* (or projecting brick) at corners; *partition and rear walls* 9 in. thick; *partitions between rooms* of 2 in. by 4 in. studs; *flues and chimneys* as shown in plans, beginning with foundation of house. The projecting courses and dentels under cornice are of brick-work.

Roof.— *Wall-plate* 4 in. by 8 in.; *rafters* 2 in. by 8 in., 2 ft. apart; *collar-beams* 2 in. by 6 in., thoroughly spiked on to rafters; slant of roof in front and rear same angle as at the sides; covered with 1 in. sheathing, and best quality of roofing tin. To the rooms in the rear, *wall-plate* 3 in. by 4 in.; *rafters* 2 in. by 6 in., 2 ft. apart; *collar-beams* 2 in. by 4 in., spiked to rafters; covered with 1 in. sheathing, and best tin. *Gutters* in boxing of cornice, with pipes at the corners in rear to convey water to the ground. Full projection of *cornice* 24 in.; *brackets* 4 in., 18 in. by 20 in.

Doors.—*Front door* 3 ft. 6 in. by 7 ft. 6 in. to spring of arch, single shutter, 1½ in. thick, upper panels filled with glass, raised moldings on both sides, hung with 5 in. loose-joint butts, best mortise-lock, porcelain knobs. Four other doors to first story, and two others to second story 3 ft. by 7 ft., with 18 in. transom to each; doors to rooms *k*, *l*, *m*, and bath-room 3 ft. by 6 ft. 6 in., with 14 in. transom; doors to closets 2 ft. 6 in. by 6 ft. 6 in.

Windows.—*Front windows of first story*, as shown in Fig. 47, 3 ft. 3 in. by 7 ft. 8 in. from floor to spring of arch, balloon *frames*, *sash* 1½ in. thick, bottom and middle glass make the lower section of sash, *sill* 2 in. thick; *front windows of second story* 3 ft. 3 in. by 6 ft. to spring of arch, *sash* 1½ in. thick, in two sections, hung with weights; *two other windows* in first and second stories (rooms *b*, *b*) same as front windows of second story; *windows in bay* are 18 in., and 24 in. by 6 ft. to spring line of arch; *windows in rear rooms*, one in the *dressing-room* of room *e* (not shown in plan), are 3 ft. by 6 ft. to spring of arch, 2 ft. from floor; *window in store-room* 2 ft. wide, same height as others; *ventilating window in front* 3 ft. diameter; *window over the bay* is 4 ft. wide, same height as others. All windows hung with weights.

Inside Finish.—*Base-board* 8 in. wide for first story, and 6 in. for other rooms, with 4 in. molding; *casings* to doors and windows 6 in., with 3 in. molding; *stairs* 3 ft. wide, with *newel* 6 in. square, *riser* 7 in., *tread* 12 in., *nosing* projects 1½ in., with 1 in. scotia, *rail* 3½ in. The stairs are near enough front door to give ample space for the rear door in hall to open. A small *closet* may be made under the stairs. *Iron mantels* are set to each grate of fire-place, such pattern as may be agreed upon.

Plastering.—A three-coat work of plaster is required, with white, hard finish, which may be given a delicate tint. Two-coat work for rear rooms and other small rooms and closets, with white, hard finish.

Painting.—All wood-work, inside and outside, has three coats of white paint, and tin roof of house, porch, and bay three coats of light brown paint, or any colors that may be desired.

DESIGN NO. 5.

TWO-STORY BRICK HOUSE.

THIS Design is the same as No. 4, with four additional rooms, and with the necessary changes to adapt the Design to the addition made. It gives abundant accommodation, and may be made a pleasant home for a minister with large family. The addition to the house will add $2,000 to the cost of building.

SPECIFICATIONS FOR DESIGN NO. 5.

The Specifications are the same as in Des. No. 4, except that, in the *front elevation*, the door is placed between the two windows, as in Fig. 48, another bay is added, also another chimney; *b* is the *study*, 14 ft. by 16 ft.; *parlor* (*c*) 16 ft. by 17 ft.; *dining-room* (*f*) 15 ft. by 16 ft.; *k* can now be used as a kitchen, and *l* as servant's-room; additional porches in the rear, and stairs as shown in plans; rooms in second story correspond with those of first story; the doors and windows same as in Des. No. 4. *Plastering* and *painting* same as in Des. No. 4.

DESIGN NO. 6.

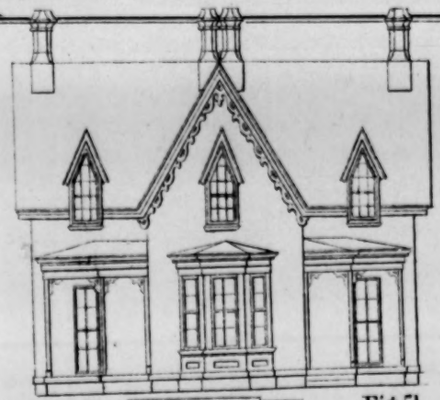
ONE-AND-A-HALF-STORY FRAME HOUSE.

IT is sought in this Design to afford much room and accommodation at the least possible outlay without detracting from the appearance. The house can be erected complete for $2,500.

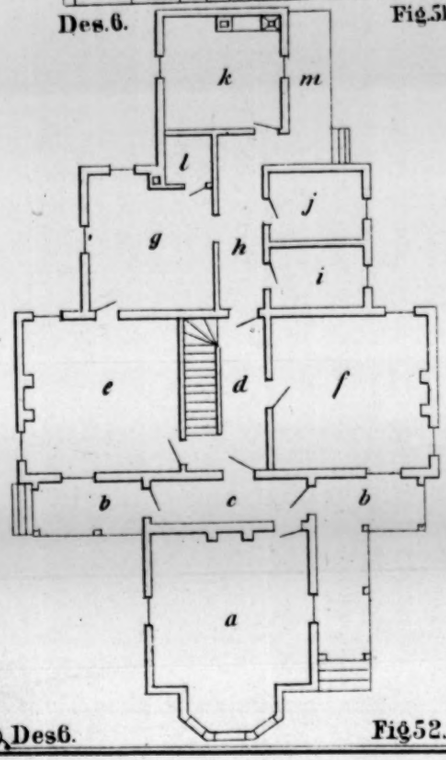
SPECIFICATIONS FOR DESIGN NO. 6.

DIMENSIONS OF ROOMS.—The first room (*a*), with bay in front, is the *parlor*, 16 ft. by 16 ft., 12 ft. ceiling; *family-room*, or *chamber* (*e*), 16 ft. by 16 ft.; *f* is the *study*, 16 ft. by 16 ft.; *nursery* (*g*) 14 ft. by 14 ft., 10 ft. ceiling; *bath-room* (*i*) 6 ft. by 10 ft.; *store-room* (*j*) 7 ft. by 10 ft.; *kitchen* (*k*) 12 ft. by 12 ft., 10 ft. ceiling.

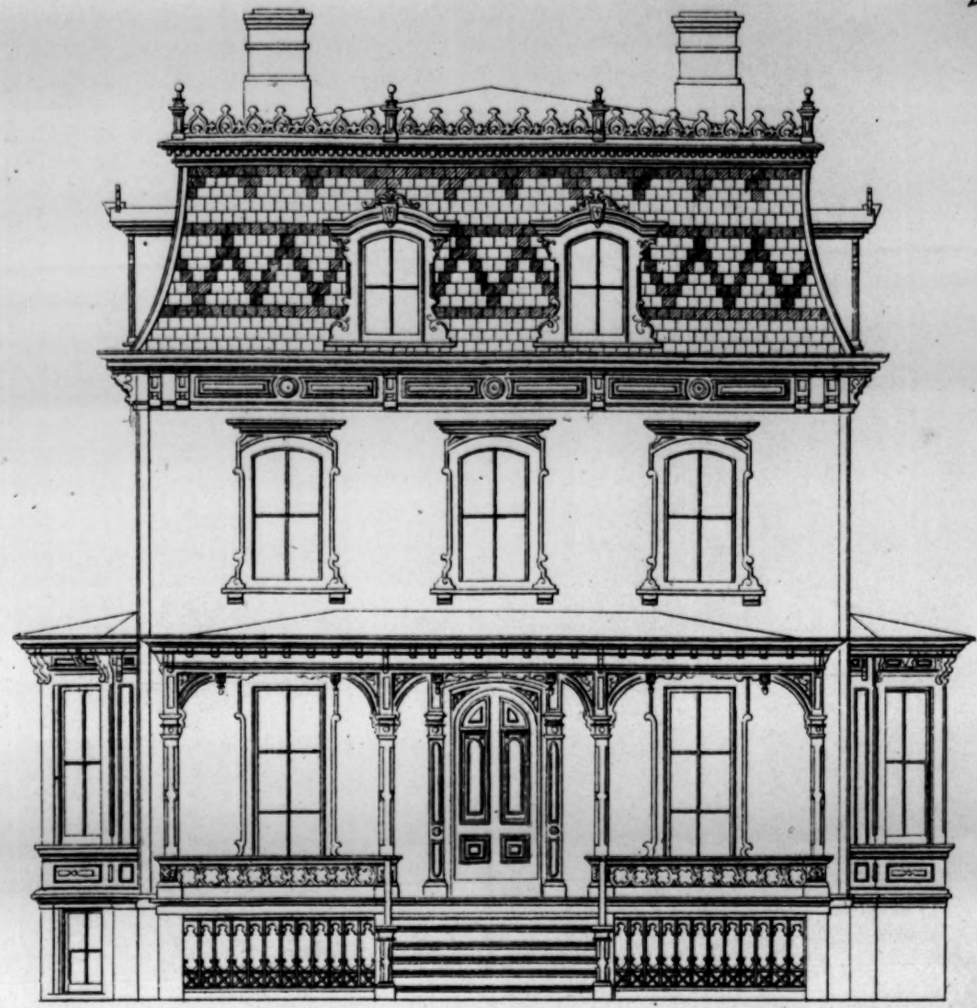
GENERAL DESCRIPTION.—*Materials* and *construction*, doors, windows, etc., same as in Designs No. 2 and No. 3. The half-stories correspond with rooms *a*, *e*, *f*.



Des.6. Fig.51.



Des6. Fig.52.



Des.7. Fig. 53.

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DESIGN NO. 7.

We have here an elegant structure, taken by permission (with some alterations) from "Bicknell's Village Builder," an architectural work of great merit, to which we are also indebted for suggestions in getting up some of our Designs. The house can be built of either brick or wood. The size and elaborate finish of the house put it beyond the reach of any but wealthy societies. It will do for a Bishop's house. Fig. 53 shows front elevation, and Figs. 48 and 49 the general plan, and Fig. 8 the mansard roof, which is covered with slate.

SCHOOL-HOUSES.

Des. 1. **Fig. 54.**

SCHOOL-HOUSES.

MUCH ought to be said—if it could be said to our people—on the subject of introducing, generally, a better class of school buildings. Many communities build costly residences, and even elegant churches, yet fail to provide a comfortable and respectable house for the education of their children. Public interest in this subject has increased recently, but there is still much room for improvement. Our remarks in reference to the heating, lighting, ventilating, etc., of churches apply equally in the case of school-houses. Indeed, these matters affect bodily comfort and health in the school-houses more than in the churches, for the former are oftener and longer occupied than the latter. Many and very strong reasons could be given for urging a decided advance in our school-house architecture in many sections of the country.*

The Designs for school-houses presented are adapted to country, village, and city, combining convenience, comfort, and taste, at a moderate expense.

DESIGN NO. 1.

THIS Design is for a house 30 ft. by 40 ft., with 16 ft. ceiling, and will accommodate about sixty pupils, seated as shown in Fig. 56. It may, however, be increased or diminished in size. Each door opens into a *lobby*, or *vestibule*, 6 ft. by 10 ft., large enough for

* This subject is treated elaborately, practically, and very satisfactorily in "Our School-houses," a work by James Johannot, Designs by S. E. Hewes, and published by J. W. Schermerhorn & Co., of New York, which work we most cordially commend, and to which we are indebted for Designs No. 1 and No. 2.

the extra clothing of the pupils. The space between these two lobbies will make a *recitation-room* 10 ft. by 17 ft. The *study-room* is 29 ft. by 30 ft. in size. The position of the teacher being next to the wall of the recitation-room, there will be no windows in the rear end of the building. The space may be filled with blackboards. Windows on each side alike. In the front corners of the study-room are two ventilating stoves, or two common stoves with ventilating flues, the openings of the duct to these flues being in the opposite corners of the room. If the situation is adapted, a basement in the rear may be made for a wood-room. Outside covered with 1 in. upright plank 10 in. wide, with 3 in. battens; or, if preferred, with 6 in. weather-boarding; roof covered with shingles. The walls should be neatly plastered inside, and all wood-work painted.

DESIGN NO. 2.

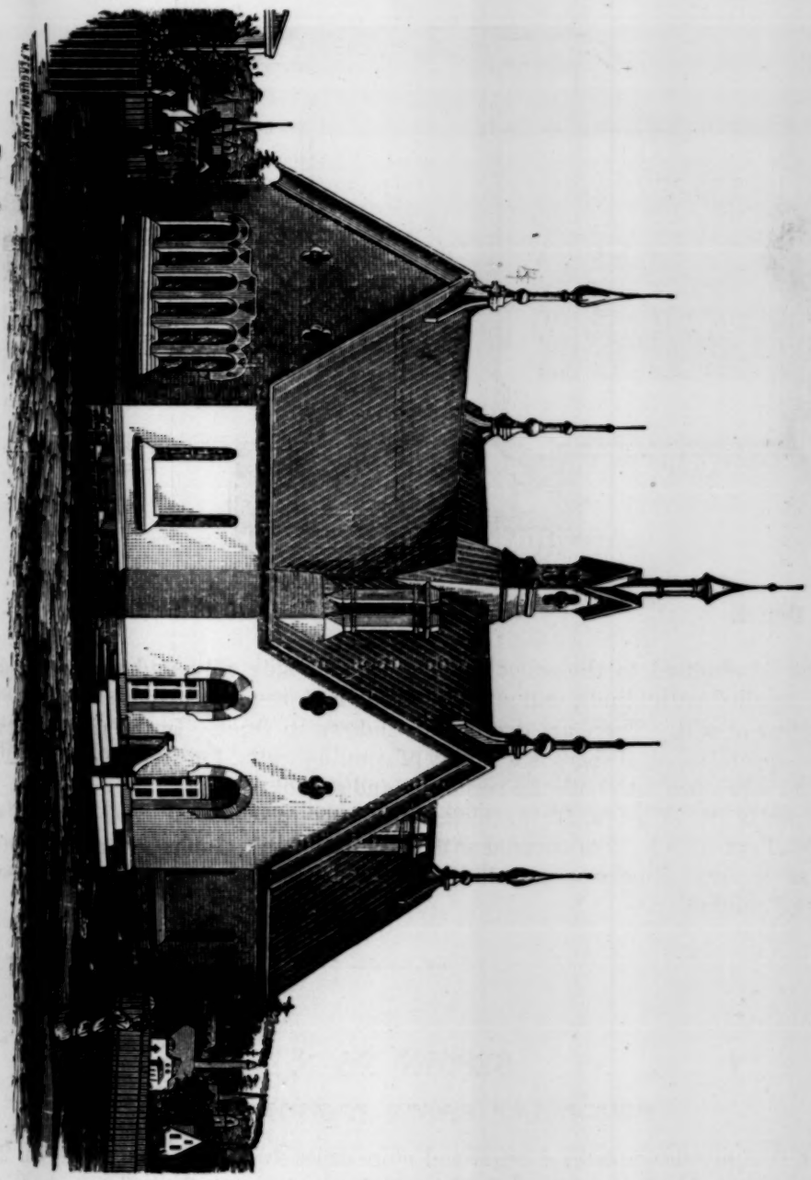
A VILLAGE SCHOOL-HOUSE, BRICK OR FRAME.

In the way of introduction to this Design, we quote the following very appropriate suggestions from the aforementioned work of J. W. Schermerhorn & Co. on school-house architecture:

"Objection is sometimes made to the erection of school-houses with cupolas, and fine windows and doors, because they look so much like churches. This objection, however, is far from being a logical one. The school and the church are both engaged in the same work, and they are complementary rather than antagonistic. There is, therefore, no good reason why the fine forms invented to ornament places of worship should not be considered as legitimate when used to ornament places of instruction. As a work of art, and as an elevating influence in community, a fine architectural structure would be the same in either case; but in a school-house its beauty would have a more practical and enduring influence, as it would become intimately associated with the impressible hearts of childhood."

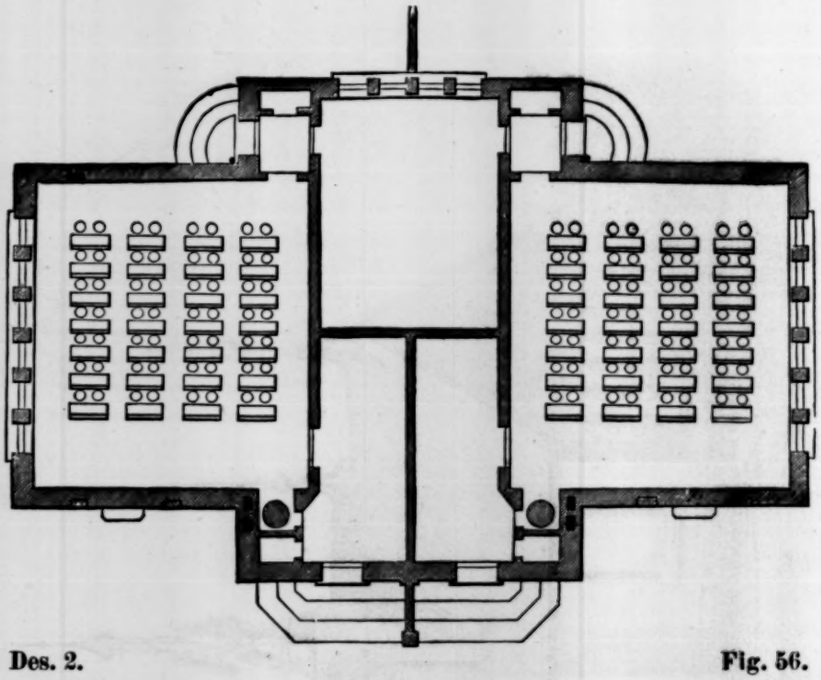
The esthetic effect of such a building, especially when favorably situated, is decidedly beneficial. The place is attractive and pleasant, and thereby has the greater influence for good. We cannot, therefore, ignore architectural taste and skill in the design and construction of our school-houses without detriment to the cause of education. Hence this Design (Fig. 55) in the style of architecture in which it is presented.

It has two commodious school-rooms and a large recitation-room, which may be divided into two, if necessary. The halls in front, as shown in Fig. 56, are sufficiently spacious for staircases if it is desired to add another story, which may be readily done. Opening into the front halls, near the doors, are two small rooms for fuel. The stoves are placed in niches in the front of the rooms, out of the way. The ventilating flues are in the corners diagonally opposite, connected with the smoke-flue as heretofore described in Church Designs.



Des. 2.

Fig. 55.



Des. 2. **Fig. 56.**

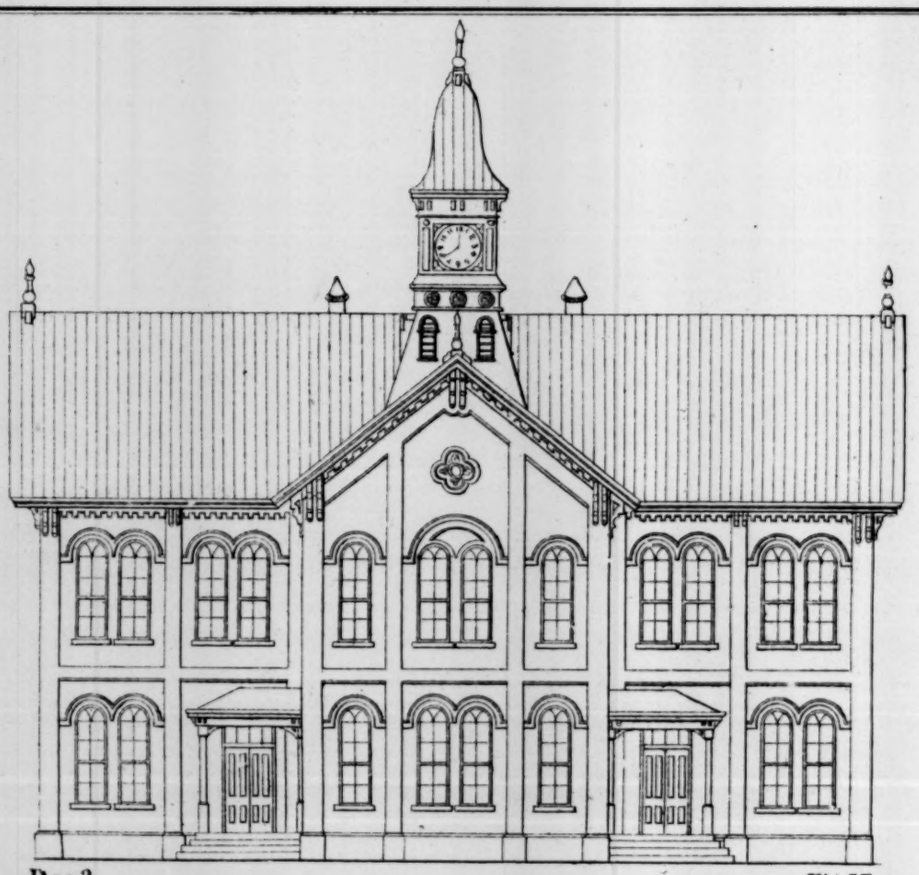
Light is admitted to the school-room upon one side only, and the large windows, properly supplied with blinds, will afford a strong and evenly-distributed light, which can be controlled at will. There are two blank windows in front. In the rear are two small rooms for apparatus, or, if there is a supply of running water, for water-closets. The small halls in the rear open into both the recitation and school rooms.

The walls are of brick, 13 in. thick, or of wood, ornamental work around windows and doors of cut stone. Roof covered with shingles or tin. Gables, pinnacles, and cupola finished as in plan. If necessary or desirable, the cupola and pinnacles, or at least the latter, may be omitted.

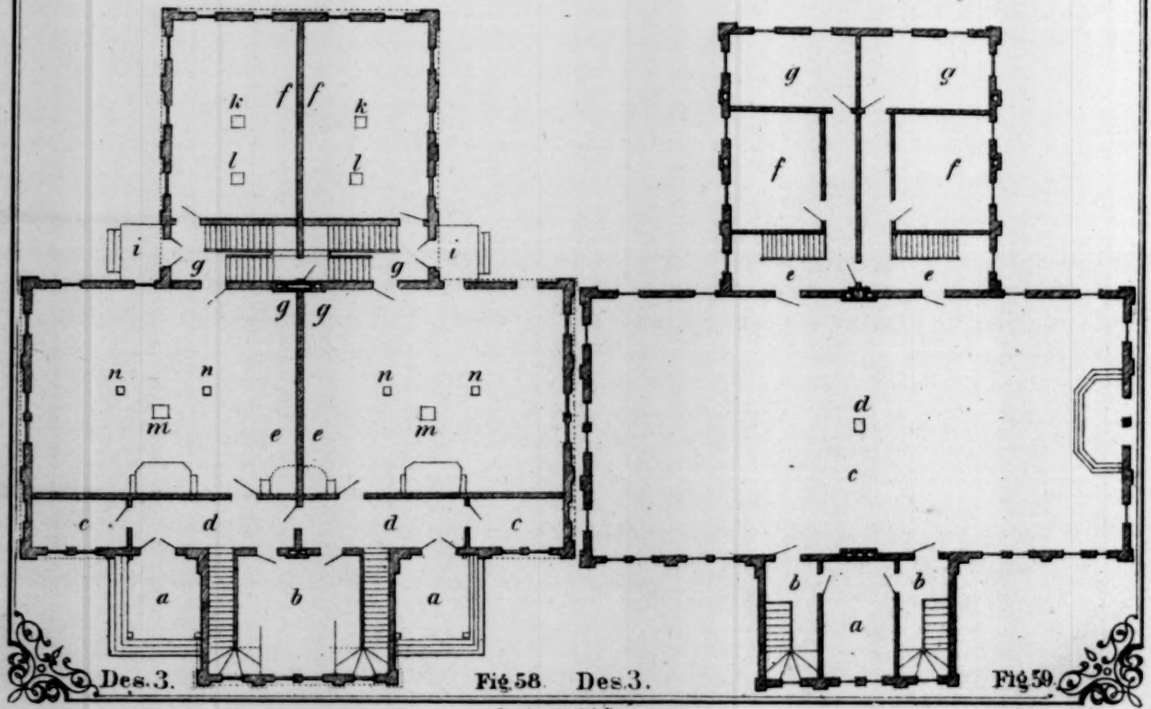
DESIGN NO. 3.

TWO-STORY BRICK SCHOOL-HOUSE.

This Design contemplates a larger and more expensive house than Des. No. 2. It was first prepared for the Union City Collegiate Institute, at Union City, Tenn., and is capable of accommodating a large school. The plan is adapted to a mixed school, where the sexes



Des. 3. Fig. 57.



Des. 3. Fig. 58. Des. 3. Fig. 59.

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are separated. If at any time desirable, the two departments in the study-rooms can be placed under the oversight of one teacher, and heard together in their recitations on each side of the wall by means of a sliding-door in the partition wall between the two rooms, as shown in Fig. 58, with a platform giving the teacher full view of both rooms; otherwise, each room has a platform for its separate teacher. The chapel, on the second floor, is easily reached from any other room in the building, or from the outside through either of four doors without passing through another room, and is capable of seating a very large audience on special occasions. The building is very substantial, convenient, comfortable, and presents quite an imposing appearance withal.

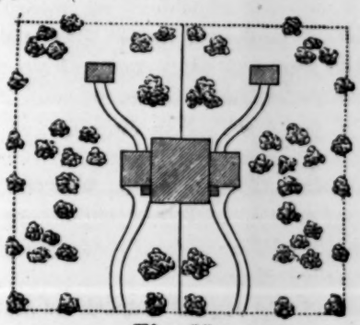

Fig. 60.

Fig. 60 represents the arrangement and ornamentation of the grounds, a subject that receives far less attention than it deserves and demands. The Figure needs no explanation—it shows for itself.

SPECIFICATIONS FOR DESIGN NO. 3.

DIMENSIONS.—*Porticos* (*a*, *a*) in Fig. 58, first story 10 ft. by 12 ft.; *office*, or *reception-room* (*b*), entered from either department of the school, 17 ft. by 18 ft.; *closets* for pupils' clothes (*c*, *c*) 7 ft. by 13 ft.; *front halls* (*d*, *d*) 7 ft. by 24 ft.; *study-rooms* (*e*, *e*) 29 ft. by 37½ ft.; *study-rooms* of primary department (*f*, *f*) 18 ft. by 28 ft.; *halls in the rear* 8 ft. wide; *staircase* 4 ft. wide. First story is 14 ft. high in the clear. *In second story* (Fig. 59) *library*, or *laboratory* (*a*), 10 ft. 6 in. by 17 ft.; *front halls* (*b*, *b*) 8 ft. by 17 ft.; *chapel* (*c*) 37 ft. by 77 ft.; *rear halls* (*e*, *e*) 8 ft. wide, and other halls 4 ft. 3 in. wide; *recitation-rooms*—*f*, *f*, 13 ft. 3 in. by 17 ft.; *g*, *g*, 10½ ft. by 18 ft. Second story is 16 ft. high in the clear, and 14 ft. in rear rooms.

BRICK-WORK.—*Foundation walls* commence on solid earth, two feet below the surface, 22 in. thick, 13 in. footings, making an offset at the top of the first joists 2 ft. 6 in. above the general level, with a cast-iron ventilating grate 12 in. by 36 in. under each window, the brick above the grate arched, or supported by 4 in. by 4 in. lintel; of rear building 18 in. thick. *Outer walls of first and second stories* 18 in.; *gables* 13 in.; outer walls of *rear part* of building 13 in.; wall between *e* and *e* in ground-plan is 13 in.; partition wall between *e* and *d* 9 in., with 9 in. footings in foundation; partitions between *c* and *d*, and between staircase and *b*, are of wood, 2 in. by 6 in. studs; partitions to rear hall and rooms 13 in.;

partition walls in second story between *g* and *g* 9 in. brick, between *a* and *b*, and other portions in rear building, of 2 in. by 6 in. studs, the partitions in the rear having two courses of 2 in. by 2 in. cross-bridging to each; *flues* as shown in the plans and hereafter described. The *pilasters* and brick *dentels* project 4 in.; *hoods* project in lower course of brick on edge 2 in., in upper course of brick on sides 3½ in. from wall. All brick are of the best quality, well burned, and for front of uniform red color; mortar of best lime and sand—for front face use clean white sand in mortar; walls straight and smooth; arches regular and true; corners square.

Wood-work.—*First joists* 2 in. by 2 in., 16 in. from centers, constituting a tie between walls, two courses *bridging* to each tier in each room, no bridging in halls; *second joists* 2 in. by 14 in., 16 in. from centers, anchored in all outer walls to make a strong tie; the chapel joists jogged and spiked into a *girder* 9 in. by 14 in., the girder being supported by *iron pillars* (*n*, *n*, *n*, *n*) 7 in. diameter, and 1 in. metal, and 12 in. foot-plate, in rooms *e*, *e*, and pillars supported by 13 in. piers, with 9 in. footings; *ceiling-joists* 2 in. by 6 in., 16 in. from centers.

Roof.—*Roof to chapel* consists of seven bents, or trusses, constructed as Church Des. No. 10, shown in Fig. 36; roof of front and rear projections, a truss to each pilaster, as in Church Des. No. 9, Fig. 30, angle of the different roofs being the same; cornice projection 2 ft.; all covered with best quality of tin.

Cupola.—The foundation of the cupola consists of *beams* 8 in. by 12 in. resting on wall-plate of front projecting walls, the back part of it commencing at the intersection of these walls with chapel walls; *uprights*, or *corner-posts*, 6 in. by 6 in., tenoned and draw-bored into the beams, and securely braced with 4 in. by 6 in. *cross-braces; plate* 4 in. by 8 in.; *corner-posts* of *belfry* 6 in. by 6 in.; *plate* 4 in. by 6 in.; *outside finish* as shown in plan, covered with tin. A *clock*, or only the bell, can be used; the former is preferable, and will cost from $250 to $400.

Doors.—*Front doors* 5 ft. by 8 ft., with 18 in. transoms; *rear entrances* 4 ft. by 7 ft., with 18 in. transoms; *doors to c*, *c*, and *b* in first story, and to *a*, *f*, *g* in second story, are 3 ft. by 7 ft., with 18 in. transoms (no transoms to *c*, *c*); all other doors 3 ft. 6 in. by 8 ft., with 18 in. transoms; all *shutters* 1⅛ in. thick, paneled, front doors raised molding, strong butts, and good locks.

Windows.—Single windows are 3 ft. by 8 ft. to spring of arch; in rear building 6 in. less in height; a blind window at each end near the front corners in first story; ventilating window, 4 ft. diameter, in each gable; *sash* 1½ in. thick, hung with weights complete.

Inside Finish.—All floors of narrow tongued-and-grooved, seasoned, dressed boards 1 in. thick; *base-board* 1 in. by 12 in., beveled edge, in first story; in second story the same, except in chapel, where it is 8 in. board with 4 in. molding, quarter-round next the floor; *casings* 6 in., with 3½ in. molding; four stairs as shown in plans, those in front 4 ft. wide, in rear hall 3 ft. 6 in. wide; stairs to furnace-room under one of the stairs in back hall.

Heating and Ventilation.—*Furnace-room* is under first floor, between two stairs in back hall, 8 ft. by 12 ft., 8 ft. high, 9 in. *wall;* the partition wall coming against furnace-room is arched over it; *passage for fuel* from outer wall; furnace sets near wall at *g*, *g;* 8 in. *smoke-pipe* runs through flue to the top, the *flue* being 13 in. by 18 in. opening; *hot-air*

pipes run to *l*, *l*, *m*, *m*, with a register to each in the floor; a wooden duct runs from *k*, *k*, *m*, *m* under the floor to the flue at *g*, *g*, with register at *k*, *k*, *m*, *m*, to take off the vitiated air, the heat of the smoke-pipe causing a strong draught in the outer part of the flue; at *d* in the chapel is another similar duct opening into the flue; in addition to this arrangement in the chapel for ventilation, two ventilating registers, from which are suspended two large ornamental chandeliers, may be set in the ceiling under the ventilating caps shown in the roof; all ventilators made to open or close, as may be desired. At the flue are also returning ducts, bringing in fresh air from a high point out-doors, opening into the rooms by a register in the wall, just above the base-boards. In the other rooms stoves are used with flues in the walls, and also the same plan of ventilating each room.

PLASTERING.—Three-coat work of *plaster* is required for the walls, and two-coat for the ceilings, mortar made of due proportions of lime and sand, and well put on; the finishing coat may be of rich "brown mortar," uniform mixture throughout, to prevent streaks, troweled to a smooth, solid face, which makes a beautiful color, or it may be tinted. In the chapel, ornamental plaster-work may be done as agreed upon.

PAINTING.—All inside wood-work and outside of doors and frames are oak or walnut grain, as may be agreed upon; sash white; outside cornice of medium shade of brown, tin roofing a shade lighter. All painting three-coat work, and all graining well varnished.

FINALLY.—The entire building is constructed of the very best class of material, and in the very best workmanlike manner.

APPENDIX.

Excelsior School Furniture M'f'g Co.,

SALESROOM, 124 *Walnut St.* CINCINNATI, O. J. C. BROOKE, *Sup't of Sales.*

MANUFACTURERS OF THE

MOST IMPROVED STYLES OF FURNITURE

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Pew Ends. On page 63 cuts of Nos. 4, 5, and 6 are given, which represent but in small degree the large variety of our Pew Ends.

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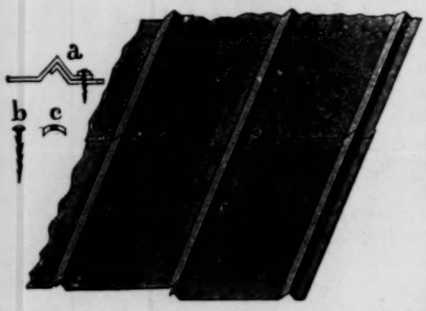

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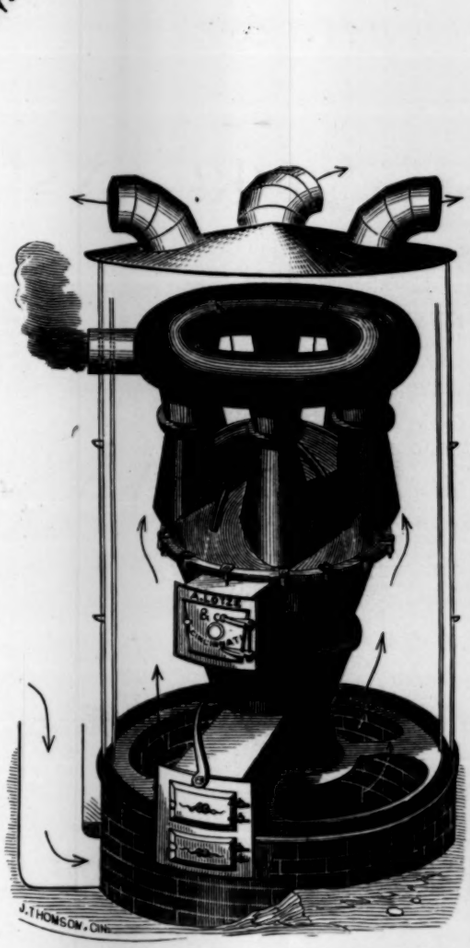

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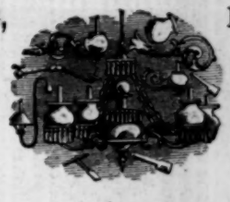

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